AVIATION WEEK

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JUNE 28, 1954

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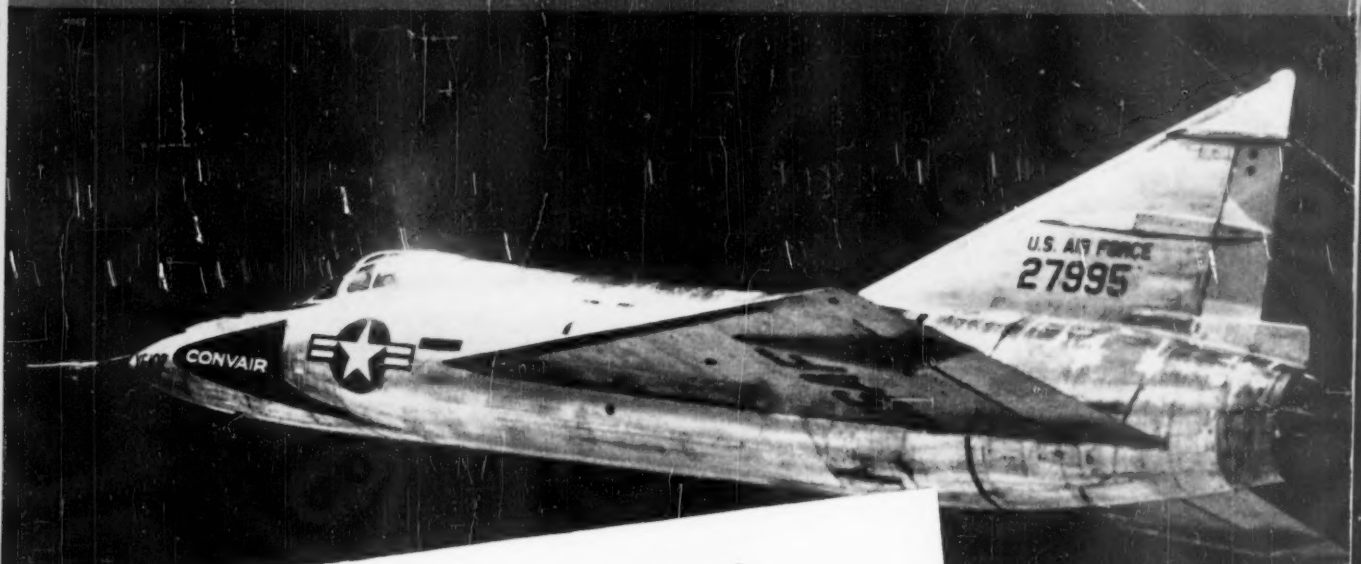

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THAT'S exactly what the ship you see here does.

She's the F-102, the Air Force's new all-weather interceptor.

Playing an important role in the F-102's all-weather supersonic performance is her yaw damper and pilot assist control system —made by Honeywell and chosen by Convair engineers after exacting tests.

This control system helps stabilize the F-102 in the pitch and yaw axes—making more precise flight possible and improving interception and marksmanship. It also relieves the pilot from flight duties during periods when he needs to give full attention to his radar, navigational and other problems.

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Flight controls like those on the F-102 are but a part of our complete line of controls for everything that flies. This line is continually expanding, as we make new discoveries and learn of new needs. Automatic control is important to aviation's progress, and *automatic control* is Honeywell's business.

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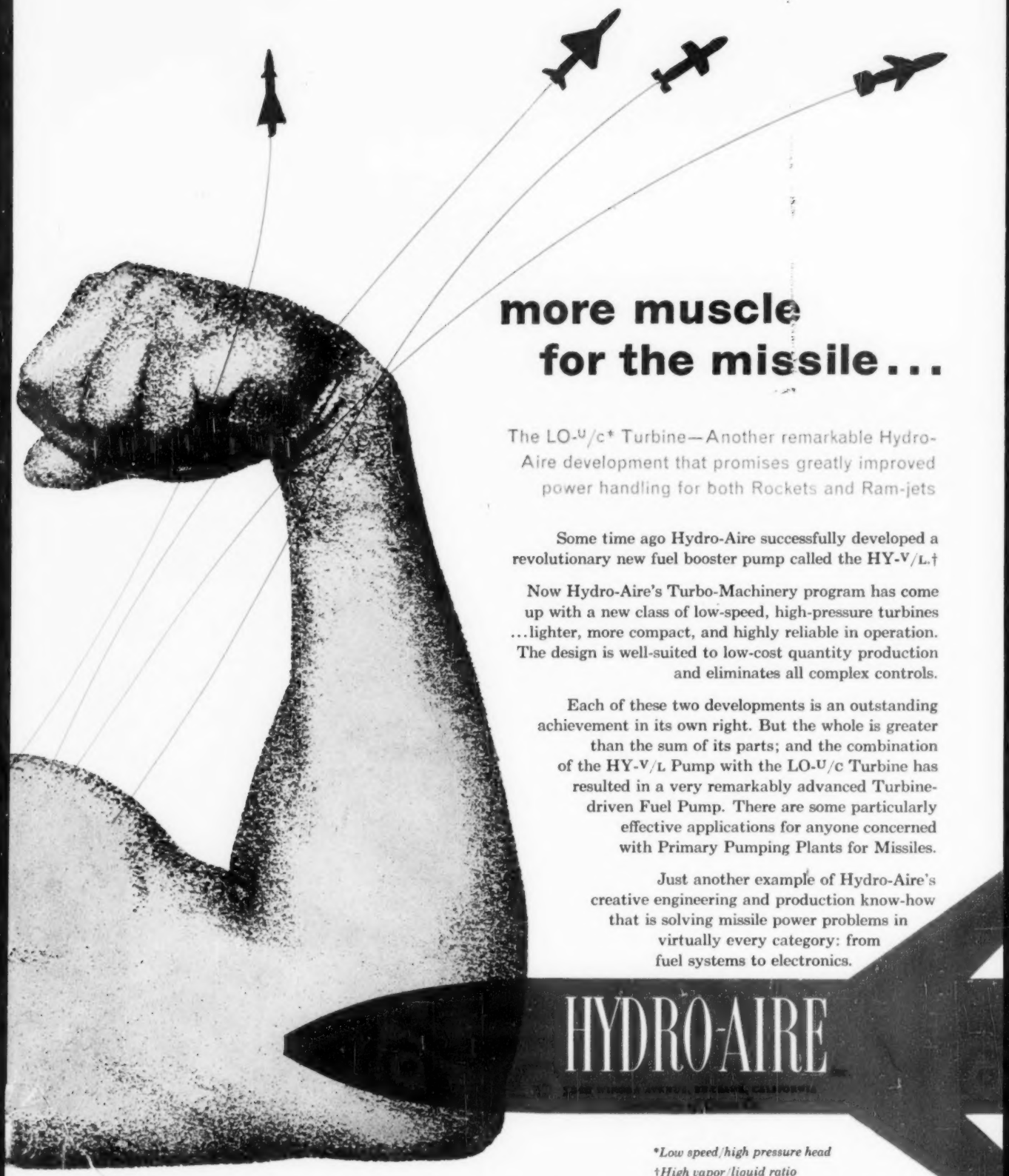

more muscle for the missile...

The LO-^{U}/c* Turbine—Another remarkable Hydro-Aire development that promises greatly improved power handling for both Rockets and Ram-jets

Some time ago Hydro-Aire successfully developed a revolutionary new fuel booster pump called the HY-^{V}/L.†

Now Hydro-Aire's Turbo-Machinery program has come up with a new class of low-speed, high-pressure turbines ...lighter, more compact, and highly reliable in operation. The design is well-suited to low-cost quantity production and eliminates all complex controls.

Each of these two developments is an outstanding achievement in its own right. But the whole is greater than the sum of its parts; and the combination of the HY-^{V}/L Pump with the LO-^{U}/c Turbine has resulted in a very remarkably advanced Turbine-driven Fuel Pump. There are some particularly effective applications for anyone concerned with Primary Pumping Plants for Missiles.

Just another example of Hydro-Aire's creative engineering and production know-how that is solving missile power problems in virtually every category: from fuel systems to electronics.

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*Low speed/high pressure head
†High vapor/liquid ratio

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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Boeing B-52 lands on strongest high-speed tire yet developed

THE B-52 heavy bomber has a gross weight of over 350,000 pounds. To land it at high speeds, the Air Force needed a tire that could take terrific impact and heat. A tire that greatly exceeds B-52 requirements and could take 50 landings at 200 mph on the dynamometer without failure. It was one of the toughest tests ever set for an airplane tire.

B. F. Goodrich engineers tackled the assignment. Using new techniques and rubber compounds, they came up with the largest capacity high-speed tire yet developed. It not only passed the "50 landings" test but was good for still more. And it passed maximum load-capacity dynamometer tests at low speeds. Cut apart for a post-mortem, it revealed *no sign* of failure. Result: the new BFG high-speed tire won official approval, is now being made for B-52's.

In addition, B. F. Goodrich wheels and Expander Tube brakes were chosen as standard equipment.

The development of this new B. F. Goodrich high-speed tire is typical of other BFG engineering accomplishments. The first low-pressure airplane tire—the first high-pressure tire—and the first high-pressure tubeless tire were all B. F. Goodrich developments.

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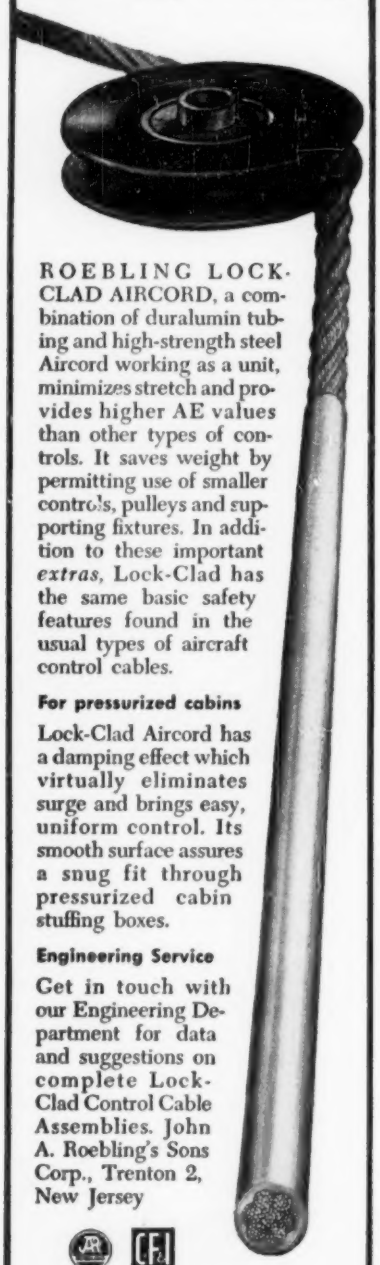

ROEBLING LOCK-CLAD AIRCORD, a combination of duralumin tubing and high-strength steel Aircord working as a unit, minimizes stretch and provides higher AE values than other types of controls. It saves weight by permitting use of smaller controls, pulleys and supporting fixtures. In addition to these important *extras*, Lock-Clad has the same basic safety features found in the usual types of aircraft control cables.

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Aviation Week

JUNE 28, 1954 VOL. 60, No. 26

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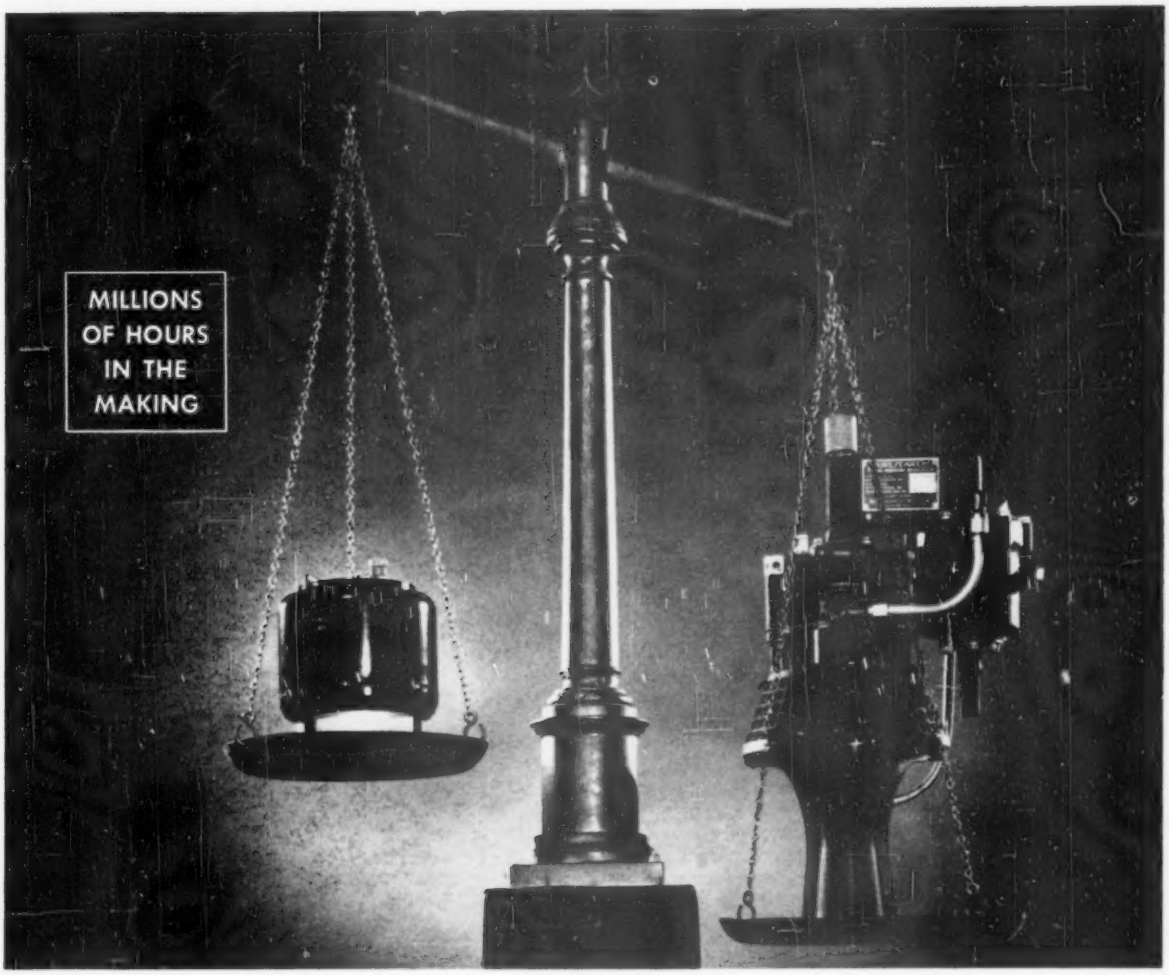

NEWEST AiRESEARCH CABIN PRESSURE REGULATOR

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AiResearch, pioneer in aircraft cabin pressurization since 1939, produced all the regulators for the Boeing B-29, only pressurized World War II airplane. These units had an airflow capacity of 15 pounds and weighed 10 pounds.

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Development of the cabin pressure regulator is another example of how AiResearch achieves ever greater performance from smaller size and weight at lower cost.

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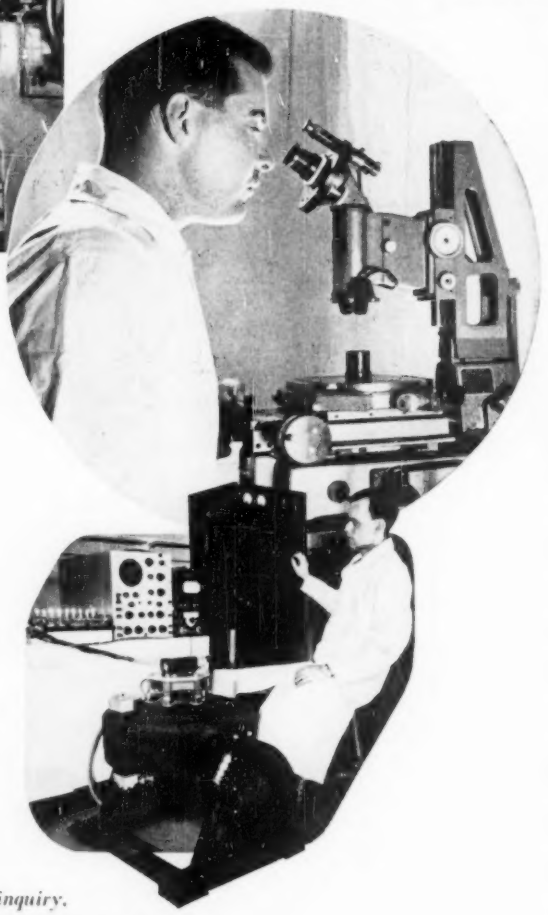

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NEWS DIGEST

Domestic

Convair's XFY-1 Pogostick was being fitted last week with spinner and yaw dampers preparatory to its first free flight, now expected early in July (AVIATION WEEK June 21, p. 26). After initial flight trials at Moffett Field, Calif., the vertical-takeoff fighter will be tested at Brown Field, an auxiliary Naval Air Station near San Diego.

Prototype C-130, Lockheed Aircraft Corp.'s turboprop-powered USAF cargo transport, has moved onto the company's Burbank flight line and is expected to make its first flight in August. Lockheed's Marietta (Ga.) Division will handle production of the C-130.

Gen. Edwin W. Rawlings, chief of the Air Materiel Command at Dayton has been awarded the Soldier's Medal for heroism in risking his life to save an injured pilot from a burning VB-17 Jan. 14 at Wright-Patterson AFB.

Rohr Aircraft Corp., Chula Vista, Calif., has received new orders for power packages and other aircraft components totaling $22,390,000 from Boeing Airplane Co., Lockheed Aircraft Corp. and Fairchild Engine & Airplane Corp. New Rohr Aircraft backlog: $130 million.

Brig. Gen. George F. Smith, vice commander of the Eastern Air Defense Force, will become chief of staff of the Air Defense Command at Ent Air Force Base, Colorado Springs, in July.

Pan American World Airways and Radio Corporation of America have been phased completely into activities at USAF's Missile Test Center at Patrick AFB, Cocoa, Fla., and are employing approximately 1,200 civilian personnel. PAA operates the facility under an Air Research and Development Command contract, with RCA as the subcontractor.

Brig. Gen. William P. Nuckols, chief information officer at NATO headquarters in France, next month will take over the Air Defense Command's 33rd Air Division at Tinker AFB, Okla. He will replace Brig. Gen. Romulus W. Puryear, who will succeed Brig. Gen. T. Alan Bennett as commander of the 24th Air Division at McChord Field, Wash.

Lear L-5 autopilot and approach coupler has been certificated for Convair 340s, following six hours of tests by Civil Aeronautics Administration in a Braniff Airways 340 at gross weights up to 47,000 lb.

Turboprop C-131C Goes to 30,000 Ft.

The new Convair YC-131C, America's first military twin-turboprop transport is seen aloft during a three-flight test program. The plane reached an altitude of 30,000 ft., setting a new record for 340-type transports, according to Convair's Ft. Worth Division. The USAF YC-131C is a modified 340 fitted with two Allison YT56-A-3s.

Flight Refueling, Inc., has started full operation of its new production plant and test laboratories adjacent to Baltimore's Friendship International Airport (AVIATION WEEK Nov. 12, 1953, p. 11).

Surplus B-29s will be put up for sale by Air Materiel Command soon at Davis-Monthan AFB, Ariz. The bombers, numbering approximately 190, are scheduled for limited reclamation of engines and some navigational and radio equipment, after which the bidder must melt the B-29s down for scrap.

Fairchild Engine & Airplane Corp. plans to build new facilities for its Aircraft Division at St. Augustine (Fla.) Municipal Airport.

Headquarters for National Advisory Committee for Aeronautics last week were moved to 1512 H St., N.W., Washington, D. C.

New Learstar, re-engineered Lockheed 18 Lodestar, has flown cross-country from Los Angeles to Miami in 9 hr. 55 min.—including a 30-min. refueling stop.

First USAF base to convert to the new federal cataloging system will be Wilkins Air Force Depot at Shelby, Ohio, Air Materiel Command has reported.

Financial

Ryan Aeronautical Co., San Diego, reports net profit of $1,054,088 for the first half of fiscal 1954, compared with $792,833 for the first six months of 1953. Gross income of the company increased from $21,530,821 to $23,540,785.

Trans Caribbean Airways has declared a five-cent dividend on Class A shares plus 5% on Class A and B stock, payable July 15 to holders of record June 30.

International

Swissair Convair 240 crashed in the English Channel June 19 after it was forced down by engine trouble while in route from Geneva to London. Six of nine persons aboard the plane were rescued, others still were missing at midweek.

New $85-million agreement has been signed by the U. S. Foreign Operations Administration to finance British production of aircraft to be used by the Royal Air Force in carrying out NATO commitments. Planes to be ordered: English Electric Canberra, Vickers Valiant, Supermarine Swift and Hawker Hunter.

Air-to-air guided missile developed by Canadair during the past three years in conjunction with the Canadian Defense Research Board is being put into production at the company's Montreal plant. Missile has been tested from Canadair-built F-86s and Avro CF-100s.

Hispano Suiza Verdon turbojet delivered 8,000 lb. thrust during a 30-hr. contractual test, according to reports from France.

Only .94 cu. inches in size—yet it carries 3-amp. loads in the 4PDT combination. It's available up to 6PDT, and with class "H" insulation.

It's extra efficient, too, having only one air gap in the magnetic assembly. By spring-holding the armature rigidly in place, and using cross-bar contacts, all alignment problems are eliminated. Insulation is inorganic, hence there is no gassing or bubbling.

The ADVANCE TQ telephone type operates on 90 milliwatts or less. Withstands 10G vibration (10 to 55 CPS). Ambient temperature range: −55°C to +125°C. Life expectancy: 1,000,000 cycles with cross-bar contacts. Open and hermetically sealed types. Write for details.

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SHARP-NOSED Douglas A4D Skyhawk, single-place Navy bomber, is aimed at quick production and early operational use (Aviation Week June 14, p. 14). Capable of carrying A-bombs, among other weapons, it has a single Wright J65-W-2 jet.

Tiny Douglas A4D Packs Big Wallop

ED HEINEMANN (photo, right), chief engineer of Douglas-El Segundo Division, is responsible for A4D's functional layout and weight paring. Small bomber can cross the U. S. nonstop. Short wings do not require complex folding mechanisms normally necessary on carrier planes. Wingspan is approximately 27 ft.

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WHO'S WHERE

In the Front Office

Carl J. Lamb is new president of Aviation Corporation of Texas, succeeding **James B. Sykes**, who has been elected board chairman of the Houston company.

Changes

Dr. Rodolfo M. Soria, former manager of American Phenolic Corp.'s Development Division, has been moved up to engineering director of the Chicago avionics manufacturer.

Stanley W. Horrocks has been appointed general manager of Aerovox Corp.'s new Special Products Division at New Bedford, Mass.

G. R. Thornton has become assistant general sales manager for Trans World Airlines. Promoted to sales directors: **Dr. J. H. Furbay**, air world education; **R. I. Robinson**, promotion; **Mrs. E. C. Kellogg**, women's department.

James R. Dempsey has been promoted by Convair to program director of one of the division's guided missile projects.

George S. Dart and **Mavo Thomas** are joint directors of Flying Tiger-Slick Airlines' new Contract and Charter Division, with Dart taking charge of eastern activities and Thomas directing the western section. Other changes: **A. V. Palma**, assistant superintendent of flight operation; **R. W. Davis**, labor relations manager; **Bert Carpenter**, manager of personnel administration; **Ralph Steen**, regional manager at San Antonio.

David A. Webster has become manager of Lockheed Aircraft Corp.'s engineering test laboratory at Marietta, Ga.

Levon Parnakian has been appointed by United Aircraft Corp.'s Pratt & Whitney Aircraft Division as manager of the airport department, East Hartford, Conn.

J. E. Callahan has joined the Garrett Corp., Los Angeles, as staff assistant to the vice president in charge of the company's new subsidiaries, Aero Engineering, Air Cruisers and Aero Sales Engineering.

Arthur F. Pelster has become manager of application engineering for airborne equipment at Leland Electric Co., Dayton.

John W. Larson, former chief engineer for Convair, has joined Chance Vought Aircraft, Inc., Dallas, as staff assistant to the chief engineer.

Honors and Elections

Mundy Peale, president of Republic Aviation Corp., has been cited by the University of Chicago for "unselfish and effective service . . . to the nation" and has received an honorary degree of Doctor of Engineering from Clarkson College, awarded for service to the aircraft industry.

Raymond O. Fredette, aeronautical engineer in Cook Electric Co.'s research laboratories, has received a Navy meritorious civilian service award for "scientific accomplishments in ballistics and aerodynamics."

Haves Dever, public relations director and secretary of Capital Airlines, has been elected chairman of Air Transport Assn.'s public relations advisory committee.

INDUSTRY OBSERVER

► Navy is working on water-cooled decks for aircraft carriers as a result of problems encountered in operating jet aircraft fitted with afterburners from its carriers, says James H. Smith, Assistant Secretary of the Navy for Air.

► Douglas test pilot Bob Rahn disclosed last week that on the initial supersonic flight of the first production Douglas F4D Skyray (Aviation Week June 14, p. 9) the aircraft reached a speed of 450 mph. before he climbed past the end of the airport property on takeoff. Rahn said he was airborne in 1,000 ft. using the afterburner on the Pratt & Whitney J57 engine. The flight from Los Angeles International Airport to Edwards AFB was made June 5.

► Aircraft deliveries to the Navy and Marine Corps in fiscal 1955 are expected to be about 500 more than the delivery total for fiscal 1954. Navy plans to operate 9,941 aircraft in fiscal 1955.

► Westinghouse J34 engines initially installed in the XF2Y-1 Sea Dart, Convair's hydro-ski, delta-wing jet fighter, have stood up well during rigorous water and flight tests. Only three corrosion spots were noted in six months of continuous operation. Two sets of J34s were used during this period.

► Lockheed T-33 jet trainers, fitted with the Martin B-61 Matador missile guidance system, are being used at the USAF Missile Test Center, Patrick AFB, Fla., to give operators economical practice in handling the Matador. The T-33s can be used over again in place of the one-shot Matador. Lockheed F-80A pilotless drone planes at the test center are equipped with carrier-type arresting hooks to catch the nylon cable-chain drag installation that halts the jets if brakes fail and the planes cannot be slowed by the time they reach the end of the runway.

► Navy Helicopter Squadron HU-2, based at Lakehurst, N. J., has completed 25,000 hr. of flight in Piasecki HUPs. First HUP was delivered about three years ago.

► Marine Corps is seeking a $3,166,000 increase in guided missile funds for fiscal 1955 over the fiscal 1954 request in order to purchase 275 Convair Terrier surface-to-air missiles. Total of 485 missiles only partially will fulfill first-year mobilization requirements for one Terrier battalion FMF, Gen. Lemuel C. Shepherd, Marine Commandant, told senators.

► USAF investment in spares and spare parts since the beginning of fiscal 1951, including inventories on hand and unliquidated obligations of that date, totals $12,243,300,000.

► Navy's program to modernize its jet aircraft operating bases, which was started in 1954, will be approximately 75% completed by the end of fiscal 1955. Naval Aviation establishment will consist of 91 stations—72 continental and 19 overseas—by the end of fiscal 1955.

► Difficulties in mating the F-84F control system with the Westinghouse E-9 autopilot, an advanced design which formed an integral part of the plane's boost system, have forced the USAF to switch to the more conventional Lear F-5 autopilot. Westinghouse expects to find other applications for the E-9, which reportedly has passed all military environmental tests without waivers.

► Navy decision sent first Allison T40 designed for vertical operation to Convair instead of to Lockheed. This may prove deciding factor in which company makes first free vertical flight tests with the VTO aircraft.

► Douglas B-66, USAF version of the Navy's A3D, was scheduled for its first flight last week.

► USAF has eliminated some high-cost producers and been able to put nearly all major contractors on a single-shift, 8-hr. operation, Air Force Secretary Harold E. Talbott reports. "The 8-hr. shift gives us a true mobilization base," he says, "because any factory geared for a single-shift operation has an immediate capacity for accelerated expansion to 250% of its normal capacity."

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National Preparing New Bid for Colonial

- **Board endorses NAL's second merger effort.**
- **EAL faces investigation of alleged CAI control.**

By Richard Balentine

National Airlines prepared last week to renegotiate a merger agreement with Colonial Airlines, 26 months after Colonial stockholders turned down NAL's original consolidation proposal in favor of an Eastern Air Lines bid.

Civil Aeronautics Board ruled June 17 that a NAL-CAI merger "would be consistent with the public interest" and ordered a "full investigation" of Eastern's alleged premature control of Colonial.

National president G. T. Baker, who told AVIATION WEEK earlier in an exclusive interview that the airline industry should start thinking in terms of adjusting rates to fit the season, had this comment on the CAB merger ruling:

"The wheels of justice are moving in the right direction. This move is in the public interest."

▶**Presidential Veto**—It was the illegal control issue upon which President Eisenhower based his veto of the Board-approved EAL-CAI merger Feb. 27 (AVIATION WEEK Mar. 8, p. 51). The Board was aware of Eastern's control at the time but felt it should not hamper a merger since the move would eliminate Colonial from $850,000 annual subsidy.

In its recent action, CAB ruled that EAL's request for dismissal of a show-cause order to determine the extent of its control over Colonial "is insufficient to warrant the termination of the investigation without a full hearing. . . .

"As to the attempted showing that Eastern does not now control Colonial," the Board said, "it appears from said motion that there are sufficient areas of uncertainty to warrant a full investigation. . . .

"It is clear that Eastern has not made such a convincing showing in its motion as would justify a dismissal of the show-cause order at the very threshold of the proceeding."

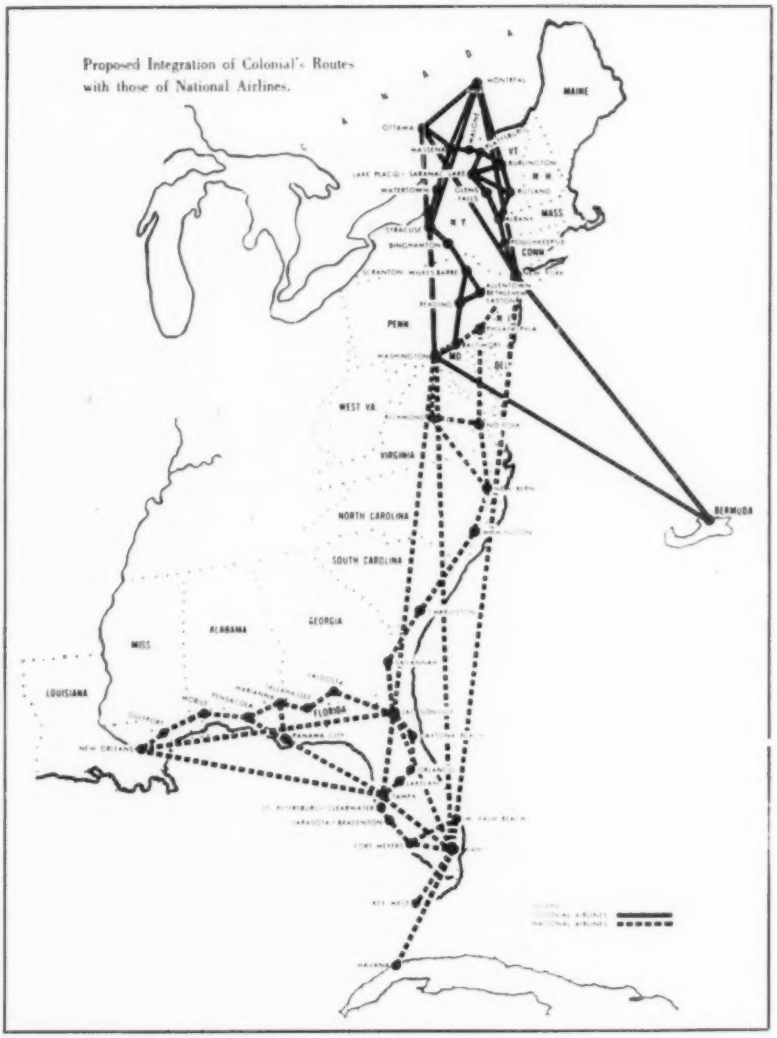
▶**Fair Price**—The Board decided that, since such an investigation would take considerable time, it should allow National and Colonial to begin negotiations immediately. CAB points out that an NAL-CAI merger would be approved "only if it were based upon a fair and reasonable consideration."

In that connection, the Board ruled that it would leave the terms of such a merger to the decision of the airlines and would not grant National's request that CAB determine a fair and reasonable price for Colonial's assets.

"We wish to make it clear however," the Board warned, "that our action here does not constitute a determination . . . that a future acquisition agreement between Eastern and Colonial would necessarily be inconsistent with the public interest if Eastern, prior to entering into such an acquisition agreement, were shown to have clearly divested itself of control of Colonial."

CAB pointed out that EAL has not "satisfactorily demonstrated" that it has terminated its control of Colonial. Until that time, "we can express no opinion concerning the possibility of Board approval of a future Eastern-Colonial acquisition agreement," CAB said.

▶**EAL Quarantine**—National has maintained from the beginning of the con-



IF MERGER GOES THROUGH, NAL would extend north to Canada, east to Bermuda.

troversy that Eastern held illegal control of Colonial.

In a petition of quarantine filed with the Board in April (AVIATION WEEK May 3, p. 78), NAL said this was "an effective assurance that no carrier other than Eastern can successfully consummate a consolidation with Colonial."

National told CAB there is an immediate risk that Eastern and Colonial would attempt to negotiate a new merger agreement. For that reason, NAL asked the Board to quarantine Eastern from any further transactions with CAI.

CAB pointed out that "National's petition does not allege any facts showing that such negotiations have been instituted or are about to be instituted or that Colonial is about to solicit a bid from Eastern."

▶**NAL View**—In Colonial's answer to NAL's quarantine petition, the airline denied that CAI or its management is under Eastern's domination.

The Board found that "Eastern's motion to dismiss the show-cause proceeding and the compliance attorney's answer demonstrate that less than 10% stock ownership of Colonial remains in persons found to be associated with Eastern. From such undisputed facts, the Board can readily make a determination without further hearings."

NAL has claimed this amount of stock is sufficient for control of Colonial. Sigmund Janas, onetime CAI president, held control of Colonial for eight years, says National, by owning less than 8% of its stock.

"National's charge that the effect of Eastern's illegal control activities still persists and is an effective assurance that no carrier other than Eastern can successfully consummate a consolidation with Colonial is without foundation and is contrary to the record," the Board found.

▶**Eastern Claim**—EAL has charged that National's real purpose is to eliminate Eastern in order to acquire Colonial "on its own terms at only a fraction of the fair and reasonable price which Eastern had offered."

When it recommended that the President approve an Eastern-Colonial merger, CAB reasoned that the combination would provide a "somewhat superior integration of the two systems in personnel utilization and in aircraft scheduling and would provide a greater volume of single-carrier service."

"It would cause less revenue diversion from National than would be suffered by Eastern if National and Colonial merged," the Board said.

▶**Route Pattern**—If the proposed NAL-Colonial merger were accomplished, National would be adding 1,380 mi.—not including CAI's New York-Bermuda route—to its present 3,092-mi. system.

NAL's routes would be extended north from Washington, D. C., and New York to Montreal and Ottawa, Canada, and east to Bermuda.

Integration of the routes of the two airlines would make available one-carrier service to passengers moving between Canada and Cuba, National's southernmost point. A further economic benefit would be the alleviation of NAL's problem of seasonal variation in traffic.

▶**Seasonal Rates**—It is this seasonal effect that prompted National to promote its "millionaire's vacation on a piggy-bank budget" plan to spark interest in a Florida vacation during the spring and summer months. National's biggest business at present comes from the fall and winter vacationers bound for Florida from New York and Washington.

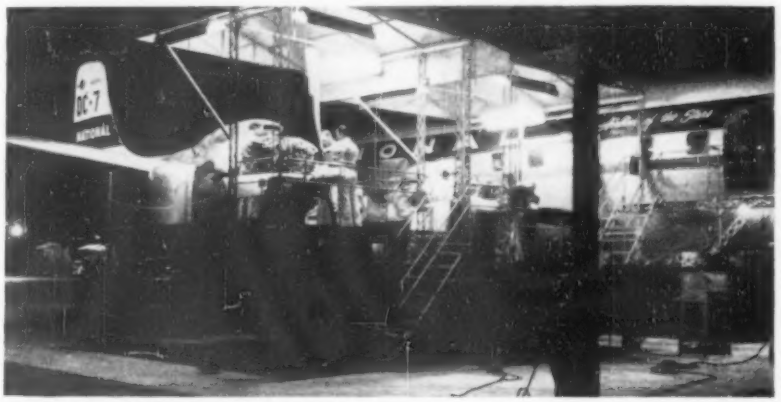
▶**Revenue Solution**—In a day when many airlines are seeking higher fares to improve revenues, Baker believes the answer lies in reducing or removing the federal tax on transportation. He also would approve of removing the round-trip discount and family-fare plans.

"Aircoach is here to stay," he says, "but I think we could raise aircoach fares a little. Any increase in first-class fares would only result in a loss of business."

National now operates better than 60% aircoach on its routes and very probably will increase that in the near

NAL'S DC-7 fleet is doing well in aircoach and first-class, president Baker notes.

NAL'S BIG MIAMI BASE typifies aviation's importance to Florida city's economy.



MIAMI CLIMATE allows National to handle outdoor maintenance on a year-round basis.

future, according to Baker. NAL was one of the first to get Douglas DC-7s into coach service, putting the transport on the most lucrative segment of its route—New York to Miami—last month (AVIATION WEEK May 17, p. 107). Early returns on the DC-7 coach indicate this move will prove a good business venture.

Only difference between first-class and tourist DC-7 flights are meals and bar service. On the coach, National serves only coffee.

▶**High Load Factor**—Baker says both services are doing well. Load factors on the DC-7 are high, bearing out his prediction last month that the new coach service would attract many "would-be" Eastern passengers. EAL, National's major competitor, is flying Lockheed Super Constellation coach service.

NAL is flying four DC-7s at present, but "we could use more," Baker points out.

Each of the 69 passengers carried in both NAL's first-class and tourist DC-7s get the red-carpet treatment. A plush, red carpet is rolled out to the loading ramp of each arriving and departing plane. This, combined with fresh flowers placed in the cabin, gives what NAL considers its "touch."

▶**Jet Noise Factor**—Baker believes jet transports are quite a few years away for U. S. domestic traffic but looks with interest at Capital's order this month for Vickers' turboprop Viscount (AVIATION WEEK June 14, p. 16). National will be seeing the Viscount under its interchange agreement with Capital on Washington-Miami flights.

"The noise factor in operation of jet transports" will deter quick conversion to jets, he says. "A whole new concept of airport handling will be needed with the introduction of jet transports. Airports will have to be located further away from cities than they are presently."

▶**Aviation TV**—At present, National is concerned about operating its own television station. Hearings were to be held before Federal Communications Commission last week in Washington. The airline wants to operate a channel in Miami.

"There are about 50,000 people employed in the aviation industry in the Miami area," Baker says. "Aviation as an industry in this area is second only to tourism. We feel that we can offer a real public service through the use of TV. We hope FCC will feel the same way about it."

▶**Management**—Baker has headed National since the company's incorporation in 1937 from a partnership in 1934, of which he was a founding member. Until recent years, the airline's policies were decided entirely by the president. Today Baker maintains strong leadership of the company, but responsibility for policy making is spread among top management executives.

In NAL's penthouse atop the Aviation Building in Miami, Baker and his executives meet at lunch daily to discuss developments and make decisions. This is his idea to save time by eliminating staff conferences throughout the rest of the day.

Recently National converted one of its Lockheed Lodestars into an executive aircraft. Baker already has made one trip around NAL's system, meeting and talking with his employes. He expects to spend more time on that project in the belief that only through such visits can its management expect to keep fully informed of the thinking and problems of NAL employes.

Hughes Blowup

- **Jordan quits in second top walkout within year.**
- **Avionics firm expects no widespread shakeup.**

Los Angeles—Another top management shakeup rocked Hughes Aircraft Co. last week for the second time within a year.

Reports from inside the Hughes organization said William C. Jordan, new general manager and vice president of the huge avionics concern, had submitted his resignation.

Jordan told AVIATION WEEK: "Any statement made will have to come from Mr. Hughes." Spokesmen for Howard Hughes refused to confirm the report.

▶**Second Blowup**—Jordan, formerly president of Curtiss-Wright and Wright Aeronautical Corp., was appointed last October to replace Gen. Harold L. George, who left the company after a dispute with its multi-millionaire owner (AVIATION WEEK Oct. 19, p. 18).

The previous management blowup at Hughes resulted in the departure of a number of top officials including these four vice presidents: Gen. George, Charles B. Thornton, Dr. Simon Ramo and Dr. Dean Wooldridge.

A company source says a similar top-echelon walkout is not expected to follow the Jordan resignation. Hughes is expected to name soon a top-ranking industrialist to replace his departing general manager.

▶**Growing Competition**—The latest development at the $200-million-a-year avionics firm comes at a time when the Ramo-Wooldridge Corp., formed by the two former Hughes vice presidents, is expanding rapidly into the same field occupied by the Hughes company. Latest reports say it soon will enter the transistor picture.

Gen. George is a director of the Ramo-Wooldridge organization, which is backed by Thompson Products, Inc., of Cleveland.

▶**USAF Concern**—The Air Force undoubtedly is watching closely the latest management troubles at Hughes. At the time of the mass walkout last September, Secretary of the Air Force Harold Talbott flew to Los Angeles to intervene in the dispute.

He made it apparent at that time that the Air Force was concerned with the effect management difficulties might have on the Hughes production. Hughes radar fire control systems are used on the F-86D, F-89D and F-94C, as well as on forthcoming supersonic interceptors such as the F-102. The Hughes plant at Tucson, Ariz., is turning out Falcon air-to-air missiles. The company also holds contracts for fire control systems for Navy aircraft.

One report said it was at the insistence of the Air Force that Jordan was named general manager of the Hughes Culver City plant after Gen. George resigned.

▶**Hughes Basket**—It has been no secret in the industry that USAF has been concerned about having all its fire control eggs in the Hughes basket. Some Air Force support has been given to the new Ramo-Wooldridge organization and several airframe companies have been looking for second sources for their fire control systems.

Jordan, who left Curtiss-Wright in 1949, is listed as director of a number of smaller firms in the aircraft field. He declined to comment on his plans for the future.

$55-Million NACA Budget Approved

Congress has approved a $55,620,000 budget for National Advisory Committee for Aeronautics for fiscal 1955.

This is $6,819,000 less than NACA's fiscal 1954 budget of $62,439,000.

For salaries and expenses, $51 million was approved, the same amount provided for fiscal 1954. The Administration requested $53 million.

For construction and equipment, Congress approved $4,620,000 requested by NACA, restoring a $271,000 House cut in final action. The money provides for these projects:

- **Ames Laboratory.** A new test section for an existing windtunnel to increase highspeed capabilities.
- **Langley Laboratory.** A new facility for research on landing and takeoff characteristics of highspeed seaplanes.
- **Lewis Laboratory.** New rocket engine test facility; alterations on an existing windtunnel to increase its speed range; additional air-handling equipment for engine research facilities.

MAY DAY DISPLAY of Red might was highlighted by this four-jet bomber, comparable in size to Boeing's B-52. Fighters are MiG-17s.

Russia Parades Airpower as 'Big Stick'

Russian propaganda aimed at promoting the power of the Red air force reached a new peak with the Soviet Air Day display June 20 at Moscow's Tushino Airport.

There is general agreement that the display underlined current Russian foreign policy of trying to impress the Western World with Red military capabilities.

▶ **The Propaganda**—Timed to coincide with the annual airpower demonstration were:

• An article by Artem Mikoyan, famed co-designer of the MiG-15, previewing the display and promising the appearance of a supersonic jet plane of rhomboid shape.

• A Moscow radio claim that a Russian test airplane had reached a speed of 1,659 mph., about Mach 2.5. (Current recognized speed mark of Mach 2.5 was set by USAF Maj. Charles Yeager last December in a Bell X-1A research plane.)

• A Moscow radio announcement that the world's first flapping-wing glider would be demonstrated at the Tushino display.

• Official Russian release of a closeup photo of the four-jet bomber that made its premier appearance over Red Square on May 1 (AVIATION WEEK May 10, p. 14). Layout of the plane points toward high-altitude operations over long ranges but hints at some speed limitations.

Press dispatches from Moscow said the June 20 display was the largest yet and estimated the number of participating aircraft at about 660, of which approximately 450 were jets. But there was no mention of either a big bomber or Mikoyan's "flying rhombus."

▶ **MiG-17s**—Military observers were impressed with a simulated landing of a helicopter-borne task force, according to the press reports.

Thirty-three giant helicopters landed light and medium artillery, jeeps, weapons carriers and troops under a cover of new fighters identified as MiG-17s by the reports.

Moscow Radio said the flapping-wing glider was towed over the field and after release it began to ". . . flap its slim wings like a seabird." Technical observers generally agree that the chief value of an ornithopter is as an aeronautical curiosity.

▶ **Photo-Interpretation**—Newly released closeup of the big Red bomber seen in the May Day display reveals its designers were aiming for altitude operation at long range. For this they chose a large-span wing of fairly large area. Judging by the size of the accompanying fighters, span of the bomber is somewhere around 180 ft.

Leading edge of the wing changes sweep angle at about the mid-span point to a slightly increased angle inboard around the thickened section at the powerplant location. Trailing edge of the wing also changes in sweep angle at a point located just outboard of the engines.

Overall planform resembles that of the British Vickers Valiant bomber.

Fuselage and tail appear conventional; the tail is unswept. This is the reverse of the usual aerodynamic practice of sweeping the tail on a straightwing airplane to avoid compressibility troubles. Such a reversal could have been dictated by Russian inability to build thin wings of large span, forcing them to use a fairly thick wing section and to sweep the wing to raise its critical Mach number.

▶ **Engine Design**—Powerplants of the bomber have been estimated at a thrust of about 15,000 lb. (AVIATION WEEK May 31, p. 12). Possible clue to how the Russians reached that figure is in the size of the inlets, which scale out at between four and five feet in diameter.

They are simple pitot inlets of circular section that meet the airstream at right angles.

It is entirely possible that the engines in this bomber are either ducted fans or bypass engines; all indications of the installation point to such a type, as does the application in a bomber where long range and good fuel economy are regarded as paramount considerations.

This does not rule out a conventional turbojet engine of large diameter, but the location, shape and size of the inlets point to a more sophisticated powerplant.

Estimated span of 180 ft. puts the new Russian bomber in a class with the B-52 of 185-ft. span. Other scaled dimensions of the Red plane: fuselage diameter, approximately 13 ft.; horizontal tail span, about 55 ft.

Tiny protuberances at the wingtips may be combustion heaters, but there is a chance that they are actually mass balances to reduce the chance of flutter on the slim wing.

—DAA

'Over the Hump'

Turboprop 'Bugs' Licked: Allison

Engine builder says high-rated turbine could be put on market by 1956 to meet British competition.

Indianapolis—A major U. S. turboprop development program is "over the hump" and production of an engine with satisfactory overhaul periods now is in sight, Allison Division of General Motors and airframe manufacturers using Allison engines reported last week.

Still unannounced engine developments are responsible for ironing out major difficulties with the turboprop engine and the recent shift from pessimism to optimism in the U. S. turboprop field.

Until now, U. S. turboprop development has lagged badly due to technical difficulties and lack of major military support.

▶ **Viscount Spurs Action**—But with these overcome, American airframe and engine manufacturers are expected to push the turboprop program ahead as rapidly as possible to meet British competition.

As a result, Allison expects commercial sales may begin in less than a year.

These new technical improvements on the Allison T40 include:

- Elimination of gearing and vibration problems.
- Simplified engine control system.
- New-type clutch.
- Automatic decoupler.
- Improved lubrication system.

Purchase by Capital Airlines of three turboprop Viscounts from Vickers-Armstrongs, Ltd., of Great Britain, with options for 37 more (AVIATION WEEK June 14, p. 16) has spurred U. S. interest in the turboprop picture.

▶ **New Stage**—With an increasing number of military turboprop aircraft either in or near flight test, pressure from the military and the airframe manufacturers also has helped bring American turboprops to their promising new stage.

W. O. Watson, sales manager of Allison, told AVIATION WEEK here last week that a high-rated commercial turboprop engine could be made available within a year and a half.

"We could provide a T38 or T40 engine earlier, but airframe manufacturers want a higher-rated engine for airline use," Watson said. (The T56, rated at 3,750 eshp., now is flying in the Convair C-131C and is scheduled for the Lockheed C-130.)

Initial delivery of Viscounts to Capital is scheduled for early next year. Deliveries of later models are to begin early 1956 and be completed late in 1957.

▶ **Customer Optimism**—Airframe manufacturers now flight testing Allison turboprops on military aircraft back up the engine firm's claim that the critical period has been passed.

"We believe the turboprop engine both in the single and the double configuration is over the hump," said J. G. Zevely, director of contracts for Convair. "The production of a turboprop engine with satisfactory overhaul periods is in sight."

Allison's T40 engine is on schedule, the company reported, and T56 deliveries likewise will begin on time. Thus far, only T56s have been delivered.

"We can meet the competition anytime now," Watson promised. "Our new engines in every respect will outperform the foreign engines—weight, fuel consumption or anything else."

"We have a well-balanced, well-designed engine," he commented.

▶ **Experience First**—Allison is ready to exchange technical information now with prospective users, but booking of orders will have to await military clearance of civil production, the company said.

It will work to the best advantage of the airlines, however, if the T56 is not pushed ahead too fast by competition, Watson warned. U. S. turboprops still are shy of service experience and this should come first, either on military aircraft or airfreighters, he said.

Allison anticipates that overhaul periods on the T56 will begin in the neighborhood of 400-500 hr. and be increased rapidly.

Watson refused to estimate what the cost of such an engine might be, pointing out that the price would depend on total production required for both commercial and military versions.

"We feel bad that the turboprop engine took so long," another Allison spokesman commented. "But we feel good about the engine now."

▶ **Commercial Use**—Military tests on the T56 now are being conducted by Convair at Ft. Worth and the engine manufacturer may ask CAA to observe the tests in order to qualify it for commercial use.

Exactly when the engine will be available is something that must be worked out with airlines, airframe manufacturers and the government, Watson said.

"It is an excellent powerplant," he remarked. "There is no reason anyone should shy away from it."

Within the past year, successful testing of a number of new technical developments has made it evident that major difficulties in the Allison turboprop program have been overcome, according to spokesmen for the engine firm and its airframe customers.

"The Allison T40 is back and is going to stay," said hydrodynamics engineer Ernest G. Stout of Convair's San Diego Division, developers of the Navy R3Y turboprop seaplane. "It justifies the heartaches we've had getting it to work. The problems are licked."

▶ **Solutions**—How some of these problems were licked is told in Allison's explanation of the latest technical developments in its turboprop programs:

- **Controls.** One of the biggest problems in the turboprop program was that of engine controls. A feeling that a single engine control was required resulted in design of an electronic control system at a time when many components of that system had not been developed sufficiently. The system has been redesigned until now it is largely mechanical, not electrical.
- **Decoupler.** Development was slowed by the decision after the program already was two or three years under way that this major component was necessary for flight safety.

It was found that failure of one turbine in the twin-power-section engines meant power from the remaining section was spent almost entirely in driving the dead turbine. As a result, the propeller went into flat pitch, creating a high drag condition which was extremely dangerous on takeoffs and landings.

The automatic decoupler, which requires no action on the part of the pilot,

Mystere Delivery

(McGraw-Hill World News)

Bordeaux, France—U. S. officials have taken delivery on the first production Mystere 4B of 215 to be produced by Avions Marcel Dassault under an $86-million offshore procurement contract.

A French test pilot took the interceptor, powered by a Hisso Tay turbojet of 6,160 lb. thrust, up to 37,000 ft. during delivery ceremonies at the Dassault plant here and demonstrated the Mystere's speed and maneuverability. The 4B has topped 800 mph. in level flight when specially equipped with a British Rolls-Royce Avon engine of 9,900 lb. thrust.

The entire offshore order for Mysteres, expected to be completed by 1956, probably will be turned over by the U. S. to the French Air Force under a program to replace American equipment in FAF with French-built planes (Aviation Week Mar. 15, p. 254).

Dassault's offshore deliveries will be interspersed with production under a French government contract that calls for 150 jets by the end of this year.

cuts the dead turbine off the line in turbine failure or loss of fuel flow.

• **Clutch.** An improved mechanical-hydraulic clutch is giving better performance. Still in the research stage but not yet flight tested is still another improvement—an automatic overrunning clutch to replace the present manual type. The principle is described as similar to that of free-wheeling in autos.

WHITE: Fight for more airmen benefits.

White Leaves USAF New Ways to Cut Costs

Assistant Air Force Secretary for Management, H. Lee White, will leave new approaches to the perennial goal of "more defense for less money" for USAF to carry on when he quits July 2 (AVIATION WEEK June 21, p. 7).

The two money-saving policies White has concentrated on since taking office a year and a half ago:

• **Keep good books.** White launched a thorough, worldwide cost accounting system for all USAF installations on the theory that much money could be saved if the Air Force knew what it had in stock. Excess items would not be ordered because USAF did not know it already had them.

Under the system, for example, Air Materiel Command will be billed for procurement funds turned over to it. AMC, in turn, will discount from its books and bill commands as they receive deliveries.

Already well along, the system will be in full effect by July 1955. For the first time, USAF will have the dollar totals of all property on hand, on order and consumed. For the first time, Pentagon headquarters will know, and be in a position to compare, the operating costs of all establishments. With this data, the search for ways to make economies can be pursued more intelligently and vigorously.

• **Invest in morale.** White has presented his case for service benefits as economy measures. "Every 1% we increase the re-enlistment rate, we save $20 million," he says. "I am in favor of swimming pools and libraries at all Air Force bases."

At Defense Department and before congressional committees, White has supported better military housing, increases in re-enlistment bonuses and allowances for medical care, overseas dependents, survivor benefits and furniture shipments as measures to meet the manpower crisis now facing USAF in building a 137-wing force.

"Numbers of men is not the answer," he says, pointing out that USAF over the past year, as an economy step, has encouraged the predischarge of men in surplus skills and men counting the days until an early discharge.

▶ **Discouraging Sample**—For quality in personnel, Air Force needs a 33% re-enlistment rate over the next three years to man 137 wings, according to White. The outlook is discouraging. A sample survey indicates only a 26% re-enlistment rate.

If USAF loses 74% of airmen whose enlistments expire over the next three years, it will lose over $1.5 billion in training and education costs, he calculates. If a 33% re-enlistment rate is attained, $682 million of the $1.5 billion will be saved.

White is convinced the post World War II trend, in full swing during the regime of former Defense Secretary Louis Johnson, to cut out service benefits as "fat" is a penny-wise, pound-foolish proposition.

His advice to USAF chiefs: Fight for the benefits for Air Force personnel that they deserve; loyalty from above will breed loyalty from below, and this is the best course to efficient and money-saving operations.

▶ **Job Split**—White's post probably will be split and filled by two Assistant Secretaries—one in charge of manpower affairs and the other in charge of financial matters. Congress now is acting on legislation to give USAF two additional Secretaries, or a total of four.

White has been in charge of manpower, personnel, organization, budget, finance, accounting, contract financing, reserve and ROTC, personnel security, civil defense, correction of military records, travel and per diem allowances.

An energetic man of 40, White "reluctantly" resigned to return to the more lucrative practice of business law. He resigned as a partner in the New York firm of Cadwalder, Mickersham & Taft to take the USAF post. A Naval officer in World War II, White switched from Naval to USAF Reserve status after becoming Assistant Secretary.

—KJ

A-Missile Test

- **USAF to launch Matador near the Iron Curtain.**
- **Trial will simulate attack against Russian forces.**

By William J. Coughlin

Cocoa, Fla.—U.S. soon will fire guided missiles in Europe for the first time, simulating atomic attack against Russian ground forces.

These will be the USAF B-61 Matador surface-to-surface bombardment missile manufactured by the Glenn L. Martin Co. Initial unit to do the firing will be the 1st Pilotless Bomber Squadron of the Tactical Air Command, transferred to Bitburg, Germany, from the U.S. Mar. 9, 1954.

Bitburg is about 300 mi. from the Iron Curtain boundary.

▶ **More Squadrons**—A second guided missile unit, the 69th Pilotless Bomber Squadron, is scheduled to move to Europe later this year. It now is stationed here at Patrick AFB for training.

A pilotless bomber squadron consists of 53 officers and 543 airmen. Number of B-61s assigned to each squadron is classified.

These are the first operational units of their kind in the Air Force.

Firings of the B-61, which can carry an atomic warhead, will simulate the tactical use to which the Matador would be put in event of a Russian attack against NATO forces in Europe.

▶ **Range to 600 Mi.**—The Martin missile is designed for close air support of the type now provided by piloted fighter-bombers. It thus fits into the U.S. military pattern of employing NATO ground troops to force superior Russian manpower to mass at points where it can be hit with tactical atomic weapons. (For logistics story on the Matador see p. 53.)

Range of the B-61A is about that of a fighter-bomber, in the neighborhood of 500-600 mi. Tactical units probably will be equipped with the refined B-61B.

Although firings of the Matador in the U.S. have been only on carefully instrumented guided missile ranges, Maj. Gen. William L. Richardson, commanding officer of the Air Force Missile Test Center at Patrick AFB, reports that elaborate instrumentation of the type used at this missile center is not required for safe practice firings in Europe. They can be fired over water or over clear land areas, he says.

▶ **Controlled Flights**—Practice missions within a limited area in Europe should

present no insurmountable problems for the tactical squadrons. Prior to testing on the Long Cape Canaveral Range near here, first flights of the Matador took place at Holloman Air Force Base, N. M., where they were restricted by the size of the range. The missiles were flown in figure eights and circles to stay within range limits.

Presumably, safety precautions similar to those taken here to protect U.S. cities along the Florida coast from runaway missiles will be enforced in Europe. These include:

- An armed chase plane which can shoot down missile if control is lost.
- Ground-controlled radio circuits which can destroy the missile in the air if it strays off course.
- Self-contained "suicide" circuit which will cause the missile to destroy itself if radio contact is lost for more than a few seconds.

Matador, similar in appearance to a conventional aircraft, has a wingspan of 28.6 ft. and a length of 39.5 ft. Powered by a modified Allison J33 turbojet engine (AVIATION WEEK June 21, p. 11), it is launched from a zero-length launcher with the aid of a Rato (rocket-assisted takeoff) unit.

▶**First Showing**—Due to the expendable nature of the missile, its modified J33 includes features designed to reduce costs.

"Less critical materials are utilized, inspection tolerances are not quite so close, inspection is not required after the initial run on the test stand, and the number of accessories is reduced considerably," Allison explains.

First public demonstration of a B-61 firing was before members of the Aviation Writers Assn. June 10 at Cape Canaveral, the auxiliary Air Force base 18 mi. from Patrick AFB.

The pilotless bomber squadrons will be completely mobile in tactical use, Gen. Richardson reports. Operating from trucks, a squadron could set up for firing within 90 minutes, he says.

▶**Range Extension**—Range of the Matador is greater than the present range of its initial ground control station. This presents no problem at Cape Canaveral where control may be passed along to down-range island stations, but requires a slightly different technique for tactical use.

Range could be extended by placing the firing base in a rear area near a port or other logistic supply source and placing the control unit near the front, perhaps 100 mi. away.

Although the missile is on autopilot for some seconds after launching before the ground controller takes over, the B-61 at present does not have an autopilot system which could be set to dive it into the target after it passes beyond the range of the ground controller.

▶**Other Techniques**—It would be possible, however, for an accompanying "mother" plane to take over control of the missile once it was airborne and direct it onto targets many miles beyond control range.

Newsmen also saw a demonstration here of how this might work. Director planes were used to fly both QF-80 and a QB-17 during remote-control flights, taking over the radio control after the planes had been airborne under the direction of a ground station. Similar techniques could be used to direct a missile to its target, a further refinement of the tactic used during the Korean war in which AT-6 spotter aircraft directed fighter-bomber strikes onto close support targets.

Although the B-61 can dive onto a target at supersonic speed, it is subsonic in level flight.

Buick's 2,000th J35

Buick Motor Division of General Motors Corp. has delivered the 2,000th Wright J65 turbojet built under a $25-million USAF contract. The Sapphire is assembled at Buick's Lyons, Ill., plant.

NEW NAVY TRAINER is Beech T34, also built for USAF and several foreign air forces.

T-34 Wins Navy Trainer Contract

Beech Aircraft Corp. has won Navy's primary trainer competition with its T-34. The prize: an order for several hundred Navy versions of the Mentor, differing only in minor details from production models being built for USAF.

In New York, financial circles report the initial T-34 order will total $9 million.

Final settlement of the competition, now almost a year old, followed submission of new cost proposals by Beech and Temco Aircraft Corp., including provision of spare parts (AVIATION WEEK Apr. 19, p. 16). At that time, Ryan Aeronautical Co., third firm to have its trainer evaluated at Pensacola (Fla.) Naval Air Station, dropped out.

▶**T-34 Economy**—Navy's Bureau of Aeronautics says the all-metal light trainer is expected to bring operating economies as well as fewer primary training accidents among student pilots.

"Certainly all of the lightplane trainer data submitted had a great deal of merit," says Rear Adm. Apollo Soucek, BuAer chief.

"Furthermore, the three planes actually tested by the training command were excellent aircraft. The T-34 was picked primarily because its cost is lower, and we felt every possible saving should be effected."

▶**Pensacola Tests**—Competition for a primary trainer began last July. Nearly a dozen firms submitted proposals.

Beech, Temco and Ryan provided planes that were put through their paces with student pilots at Pensacola. The Ryan aircraft was rejected primarily because it had side-by-side instead of tandem seating, Navy says. This left the T-34 and the Temco Plebe in the race.

The Beech model is powered by a 225-hp. Continental engine. It has a top speed of 180 mph. and will operate with a takeoff weight of about 2,900 lb. Like all Navy primary trainers, it will be painted bright yellow.

A low-wing monoplane, the T-34 is equipped with retractable tricycle landing gear.

▶**Lower Costs**—In addition to lower unit cost, BuAer says, the Mentor's operating expense on a per-hour basis will be only a fraction of what it costs to use heavier equipment.

The Navy's present basic trainer, the North American T-28B, will be used for the second step in student training. The T-34 and T-28B eventually will replace the famous North American SNJ, in which all Navy pilots have checked out since 1940.

First deliveries of the T-34 are expected within a year.

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★ Designed to meet AN-M-40 specifications

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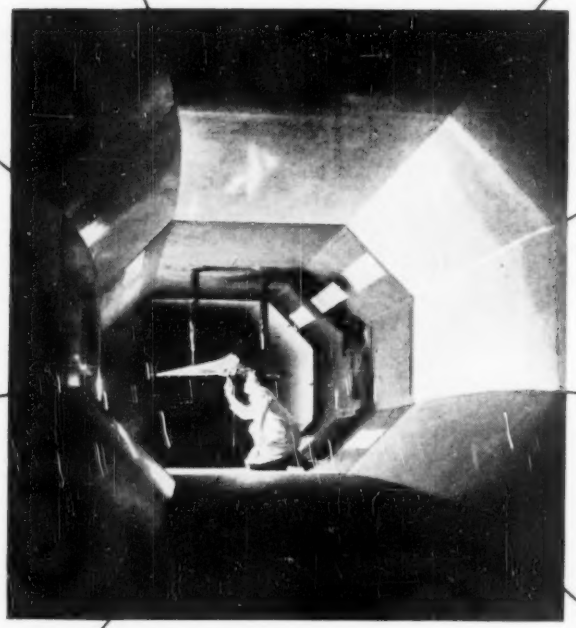
S-526

Storm in a Test Tube



The first test flight of every newly-designed Avro aircraft is made in a laboratory wind tunnel.
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Shown in the wind tunnel of our picture is a model of the Avro Vulcan, the world's first 4-jet Delta Bomber. This is the aircraft whose revolutionary planform best fulfils the needs of long-range, high altitude flight with heavy loads at near-sonic speeds.
The success of the audacious new shape is a fine tribute to the pioneering genius of the Avro team ; to the thinking of the designers and technicians ; to the painstaking care of the model makers and those who use the models ; to the know-how of the production engineers and the skill and enthusiasm of the men and women in the workshops ; to the research engineers, specialists and test pilots.
Thanks to these and a courageous and virile management, the Avro Vulcan is now in super-priority production for the Royal Air Force.

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Why AF Is Slashing Obligations

Officials cite F-84F program as example of rushing into production and finding 'it is not all we expected.'

Detailed discussion of the F-84F Thunderstreak production program was offered by top USAF officials to explain current procurement problems to members of the Senate Appropriations Committee.

The discussion was triggered by Sen. Homer Ferguson, chairman of the Subcommittee on Military Appropriations. Ferguson questioned Lee White, Assistant USAF Secretary for Management, on the validity of criticism that current USAF fiscal policies are providing combat aircraft inferior to those of the enemy.

▶ **F-84F Example**—White answered: "The answer to your first question is 'No.' . . . I think I can go back and give you an example of the F-84F as an illustration of going ahead and deciding we have a plane and spending money and finding out it is not all we expected.

"The F-84F was meant to be an extension of the F-84E. They rushed into production with it and the F-84F didn't work out as quickly as expected so that the system of moving ahead fast resulted in spending a lot of money and in probably getting less, because when you have the money in the program you don't like to back out of it.

"The delays in this program were so . . . substantial that deliveries of this airplane will overlap . . . with deliveries of more modern planes which will soon be available. The experience with this airplane is an example of what happens when a new model is rushed into quantity production.

▶ **Delivery Overlap**—"The original letter contract for the F-84F airplane was signed in July 1950. The F-84F was placed into accelerated production at the outbreak of the Korean war due to the urgent need for a fighter-bomber with increased performance. . . .

"The Air Force went ahead full scale, spent a lot of money on the F-84F and is only now finally getting a satisfactory plane. When the money got tied to the F-84F we had to stay with that plane rather than moving to a better plane. The delivery of that plane is overlapping with deliveries of a more modern plane. We would have gotten it faster if we had gone slower in the beginning.

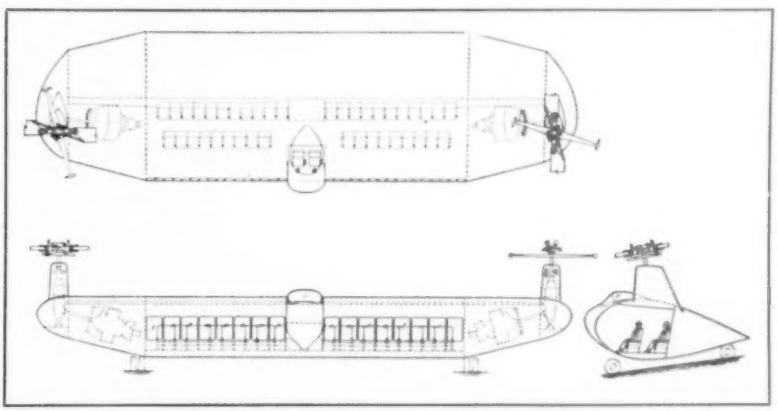
"We are now making sure that before we get into a plane and get ourselves tied to that plane, we have a plane that will work and will be a good one."

▶ **Tail Trouble**—Maj. Gen. Oliver Picher offered the following comment in response to questioning by Sen. William Knowland of California:

"The F-84G flew in Korea and was a fine airplane. What you are going to get out of the F will be a better airplane. It is not a useless airplane and it is going to get well. It has slipped in time a great deal, due primarily to difficulties with the tail which they are working on."

Sen. Ferguson asked Gen. Picher if his comment on the F-84F tail difficulties was unclassified. Picher replied: "Yes, sir. I think it is well known and has been written up in aviation magazines."

Sen. Ferguson: "We usually get our



Inside the New Bell Copter

This diagram details the powerplant and seating arrangements planned for the novel new Bell wing-shaped copter. Shown here is seating plan for 40 passengers; layouts can be adapted to 20-50 seats. The wingtip rotors are driven by either Wright R1820 or P&WA R2800 piston engines, but the design is adaptable to turbine powerplants.

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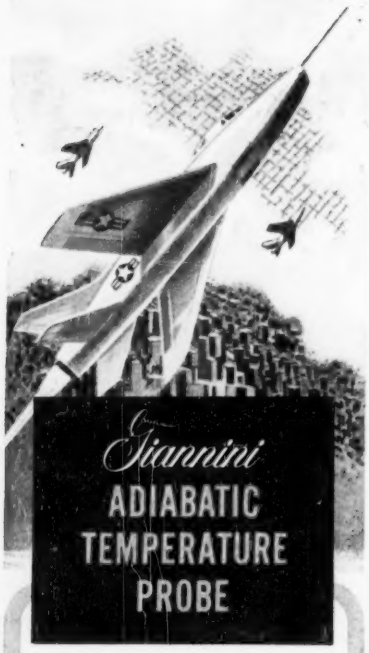

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personal information from the press."

Gen. Picher: "I do too."

White inserted in the committee record the following statement as the official USAF history of the F-84F programs:

"The F-84F program was initiated in mid-1950 after Republic Aviation had submitted proposals to increase the performance of the F-84G by changing to a swept wing and using an increased thrust engine. Because of the Korean requirement, which I mentioned earlier, in the fall of 1950 the first procurement of several hundred planes from fiscal 1951 funds was ordered on the basis of preliminary designs.

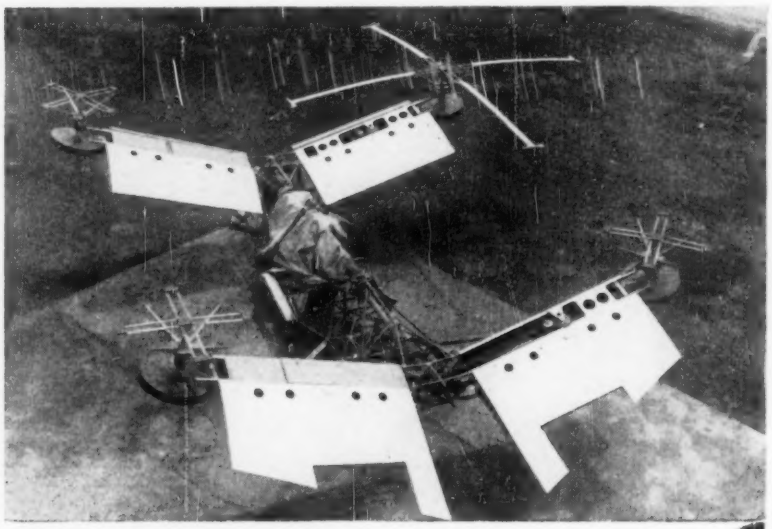
"No prototype had been tested and, in fact, design and production engineering had yet to be completed. Quantity procurement of the plane was made at this early stage of its development because it was thought that the F-84F was simply a further development of the F-84G, which was already being successfully produced.

"The F-84F was to be powered by a brand new engine of British design. This engine had not as yet been completely 'debugged,' but a prototype was available. The engine was to be production-engineered by the United States manufacturer to American standards. The British drawings were to be redrawn only to provide for United States measurements and threads.

▶ **Problems Underrated**—"The original production schedule for this plane, prepared in August 1950, called for the first deliveries of the production version by the fall of 1951, about a year after the start of production. The first production models were not delivered until the end of 1952, 14 months after the original schedule date.

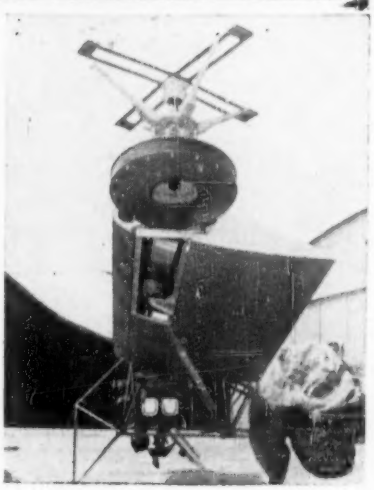
"Production of any great quantity of airframes was not achieved until the middle of calendar year 1953. The difficulties involved in the production of the F-84F and its engine had been grossly underestimated at the time the plane and the engine were put into quantity production.

"As work proceeded on both the



Convertawings Readies New Compound Copter

First views of Convertawings' Model A quadrotor compound copter outside its hangar at Zahn's Airport, N. Y., detail the prototype's interesting layout. Craft is powered by two 90-hp. Continentals, one at the front and one at the rear. They supply power to the four rotors at the tips of the wing-like extensions. The single-place Model A is expected to begin tests next month. The cutouts in the wings (foreground) are for elevators. The drive system utilizes multiple V-belts and individual over-ride clutches into a fuselage drive shaft. Neoprene and nylon-coated cable belts transmit power from the fuselage-mounted shaft to individual rotors. Rotor hubs (right) employ a simple blade retention and control system.



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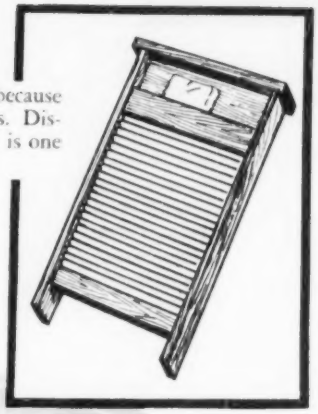

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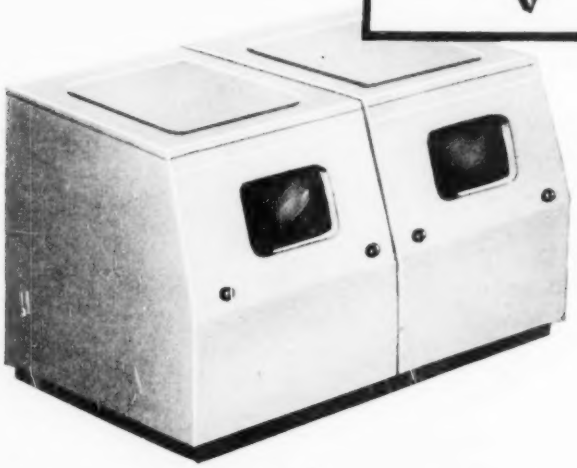

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airframe and the engine, a number of serious design and production difficulties were encountered. The relatively simple changes to the F-84G envisioned in the original proposal disappeared along the way. Instead, a new F-84F appeared with a wing design utilizing spars. . . .

"The production of these spars required the use of heavy presses, the available capacity of which fell far short of that required for this and other programs. These spars were to be fabricated of two large forgings, rather than numerous bits and pieces as had formerly been the case. . . .

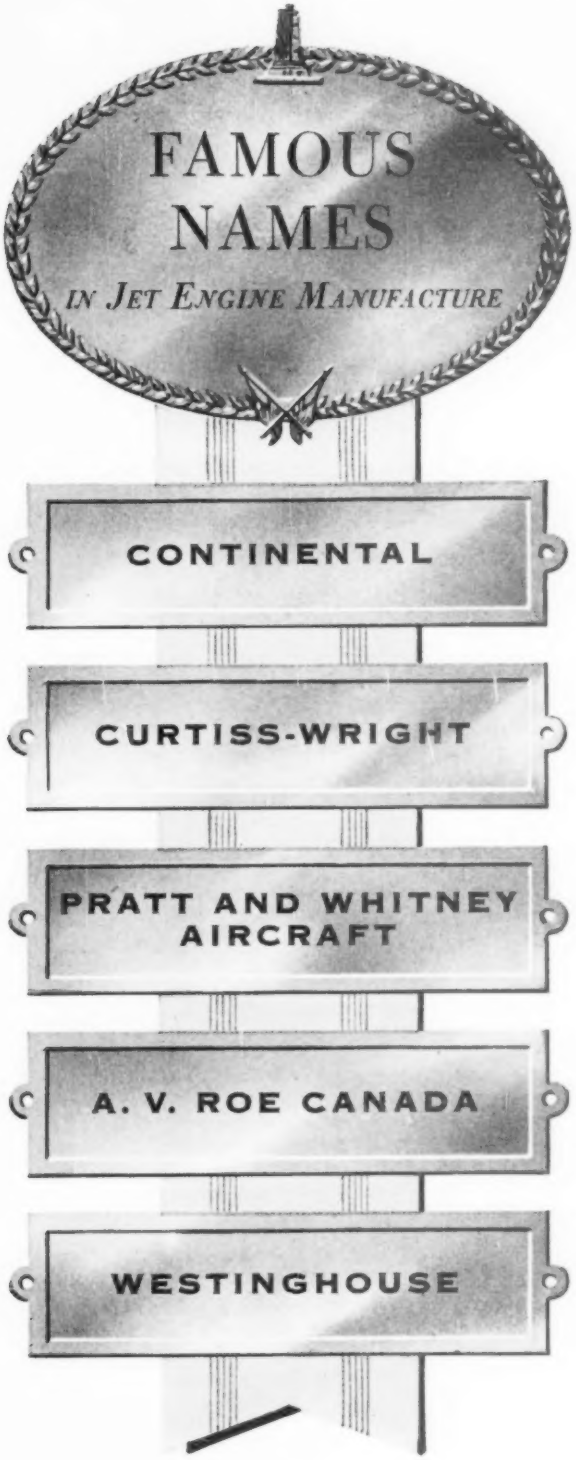
▶**Press Breakdown**—"As early as July 1951 the contractor advised the Air Force that it was experiencing difficulty in meeting its contract schedule for both the fighter and reconnaissance versions of this aircraft due to a serious delay, both in the production of wing forgings and in the receipt of an acceptable engine.

"A breakdown of the country's largest heavy forging press greatly aggravated this situation. The wing had to be redesigned to enable construction with available tools and facilities. In addition, numerous structural problems arose during the course of production necessitating a large number of major engineering changes, not only to the airframe but to the engine and other components as well. As a result, it was necessary in September 1951 to revise the schedules for these aircraft.

"At about this same time, the requirement for these aircraft was substantially increased under the Air Force's 143-wing program, and additional procurement was programmed. An additional contractor was brought into the picture as a second source producer of the plane. Also, to meet the increased requirement for the engine, a second source producer of the engine was established. The second source contractors inherited the same production problems. . . .

▶**Orders Reduced**—"During the past year, most of the design and production difficulties have been resolved and more realistic production schedules have been established. The delays in this program, however, have been so substantial that deliveries of this airplane will overlap with deliveries of more modern airplanes which will soon be available. Action has already been taken to reduce the number of these airplanes on order.

"The experience with this airplane is a prime example of what happens when a new model is rushed into quantity production. Our new production policy of not committing large quantities of airplanes to high rates of production until adequate testing and production experience are accumulated should minimize the occurrence of this type of situation in the future."



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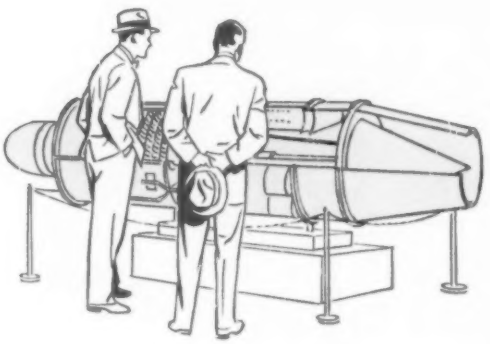

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Convertiplane vs. Copter

The working group on convertiplane aircraft of ACC has classified convertiplanes by speed and the weight penalty they pay over a well-designed helicopter. Here are the figures:

Type	Normal cruising speed (knots)	Gross weight compared to equivalent helicopter
Helicopter	100-130	100%
Helicopter with fixed wings	130-150	105
Convertiplane with partially unloaded rotor	160-200	115
Convertiplane with completely unloaded rotor	200-300	120
Convertiplane with tilting rotor	250-350	120
Convertiplane with tilting fuselage	300-400	125
Convertiplane with rotor as fixed airfoil	300-400	115
Convertiplane with retracted rotor	400 up	125

Group Asks Convertiplane Subsidy

By Claude O. Witze

Government sponsorship of a commercial convertiplane has been suggested to the Air Coordinating Committee by its working group on convertible aircraft, headed by Col. William B. Bunker, assistant chief of Army transportation.

In its survey of convertiplane configurations, the committee says, manufacturers of fixed-wing planes gave the impression they are so interested in better flight characteristics that they neglect other performance factors, such as landing and takeoff.

▶ **Speed Factor**—"Particularly," the report notes, "are the designers loathe to propose any developments which improve these areas which are regarded as secondary if they entail, as they usually do, some sacrifice in the speed or empty weight of their aircraft."

The committee's report was sent to ACC last week. Its specific recommendations have not been made public, but Col. Bunker discussed the text of the study at a recent meeting of the American Helicopter Society.

Primarily a review of current convertiplane configurations, the first section of the report points out the economic advantages that could result from transport-type convertiplanes.

▶ **Disadvantages**—The committee says the concern of manufacturers with bigger and faster, fixed-wing transports "results in the user, or more frequently the government and the citizens, having to pay the cost of this increased performance with larger airfields, greater noise and higher vibrations."

The report says: "This seems to account for the willingness of the helicopter manufacturer on the one hand to accept these principles while the fixed-wing manufacturers do not regard them seriously. . . .

"Paying increasing costs for larger and larger airfields and traffic facilities is encouraging the practice of engineering for higher aerial performance and letting the public bear the cost. . . ."

▶ **Research**—The committee's conclusion follows an observation that most work done on the convertiplane to date has been along the lines of improving the helicopter, trying to make it more competitive with the airplane in forward flight.

On the other hand, the group reports it could not find much evidence that anyone is trying to apply the convertiplane idea to the airplane, making it more competitive with the helicopter and cutting landing requirements.

The only research in this field worthy of note, the committee finds, is the effort to reduce the stalling speed of airplanes by use of boundary layer control and large propellers to increase airflow over the wings. It is pointed out that success in these fields may discourage interest in convertiplanes.

Other conclusions in the study are:

- There are no major technical obstacles to prevent construction of a convertiplane of the partially unloaded rotor type. The McDonnell XV-1 is an example of this configuration.
- More basic research must be done before production is possible of a convertiplane with a completely unloaded rotor, where fixed wings would provide all the lift in forward flight.
- The convertiplane with a tilting rotor that can be turned into a propeller has technical limitations, but they will be solved in a few years.
- The types on which the rotor would be stopped altogether in forward flight are "feasibility questionable."

The complete report of the group, including specific recommendations,

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will be considered by ACC and used as a basis for federal policy.

In addition to Col. Bunker, members of the group making the convertiplane study are: Richard K. Waldo, Civil Aeronautics Administration for the Department of Commerce; E. Bruce Miller, Civil Aeronautics Board; Robert Rosenbaum, CAA alternate for Department of Commerce; Maj. R. J. Wallman, USAF member; Robert S. Knecht, Navy Bureau of Aeronautics member; Norman J. Asher, Office of Naval Research, alternate Navy member, and Ronald C. Kensey, ACC representative.

CAB Limits Airlines On Joint-Fare Action

Scheduled airlines now may get together to discuss how to increase revenues, provided they limit the discussion to methods other than raising rates and fares, Civil Aeronautics Board rules.

Since this qualification severely limits Air Transport Assn., it is expected that an association board meeting in New York will ask for reconsideration.

▶ **Earnings Cited**—The airline group asked the Board last month for an authorization "broad enough to permit the industry to discuss and consider all possible methods of increasing revenues except compensation for the transportation of mail, which is being separately considered."

But the Board reasons that ATA "failed to make a convincing showing that rate or fare changes are needed at this time. For the last several years," CAB says, "the airline industry has enjoyed an extremely favorable level of earnings."

ATA told the Board the decline in earnings reported in the first quarter (AVIATION WEEK May 17, p. 104) was likely to continue. CAB argues that available evidence is not sufficient to warrant such a prediction.

▶ **'Premature'**—"It is worthy of note," the Board says, "that while unit costs have remained stable or slightly declined and, while traffic has continued to increase, load factors and, as a result, earnings have declined.

"In a situation where industry earnings appear to be declining primarily because the growth of industry capacity has temporarily exceeded the growth in its traffic, it would appear to be premature to rush into a consideration of basic fare changes as a remedy. . ."

CAB points out these factors as conditions of the airline industry:

- Profit or loss is sensitively geared to load factors.
- There is substantial lag between placement of orders and delivery of new equipment.
- Under even the most favorable conditions, earnings fluctuate.

"Stability in fare and rate levels is a major goal of any transportation industry and this makes it especially important in an industry as subjected to short-term fluctuations as the airline industry that changes in basic fare and rate level should not be too closely tied in to short-run fluctuations in earnings," the Board says.

▶ **Fare Criteria**—"It is our belief," says CAB, "that both the public and the industry should be better served by a level of fares which would reflect the cyclical need rather than the needs of any particular year.

"With this philosophy in mind, it is our intent to examine any future fare or mail rate proposal not only in the light of conditions prevailing at the time they are advanced but with full consideration of the abnormal earnings of prior years and the excess earnings which may be expected in the future. . ."

The Board warns that, should earnings fall markedly in the future, airlines will be expected to absorb losses without resort to fare or mail rate adjustments unless "it can be demonstrated that such earnings are below the level necessary to provide a fair fare return over a reasonably extended period—which includes the good years as well as the bad."

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Hexcel Glass-Fabric Honeycomb may be *pre-curved* to contour to speed layup time, reduce fabricating costs.

Here's a closeup of the top radome, composed of Hexcel Glass Fabric-Plastic Honeycomb in ¼" cell size, faced with glass fabric skins.

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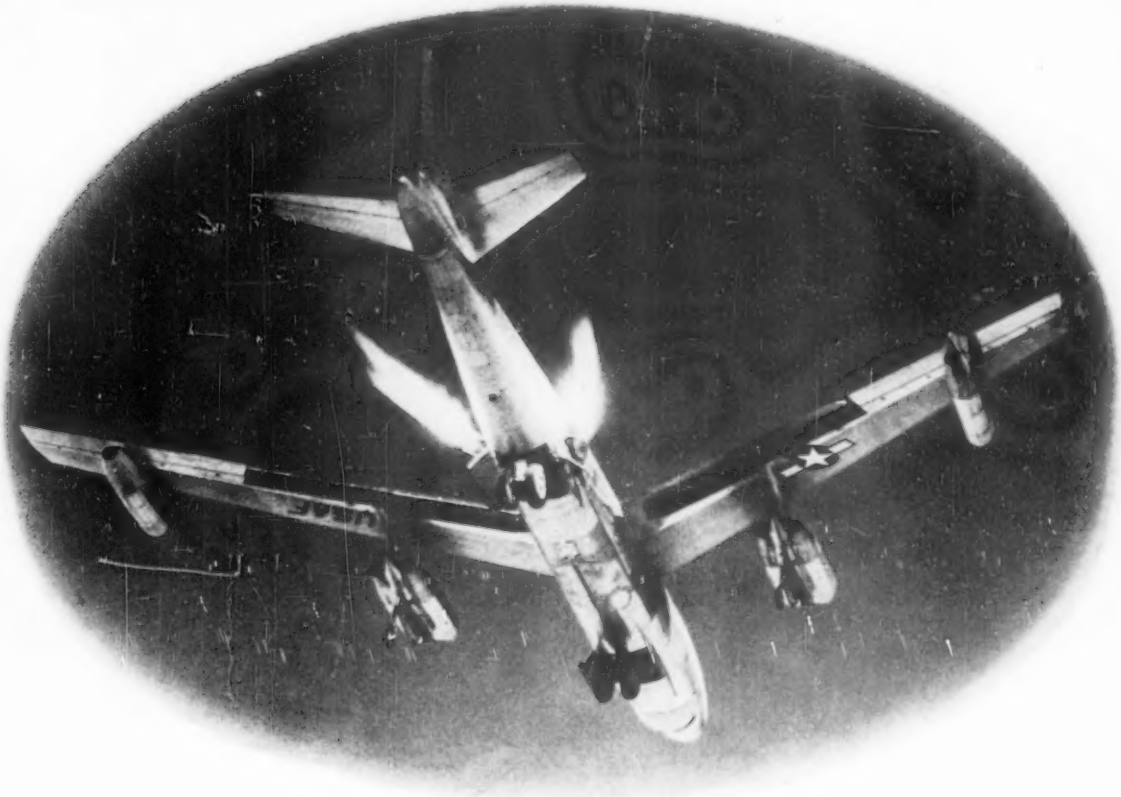

INCREASED PAYLOAD FOR THE AIR FORCE B-47

This spectacular photograph shows the Boeing B-47B Stratojet shortly after takeoff assisted by Aerojet-General liquid-propellant rocket powerplants.

The new, high-thrust dual rocket installation — which has successfully undergone some of the most severe safety and reliability tests in the history of rocket power — retracts into the fuselage after use, leaving the aircraft aerodynamically clean.

The outstanding success of this project is the result of the cooperative efforts of the Boeing Airplane Company, Aerojet-General Corporation, and the United States Air Force. As the nation's largest company devoted to rocket power, Aerojet-General is working closely with the Air Force to maintain an unparalleled air superiority.

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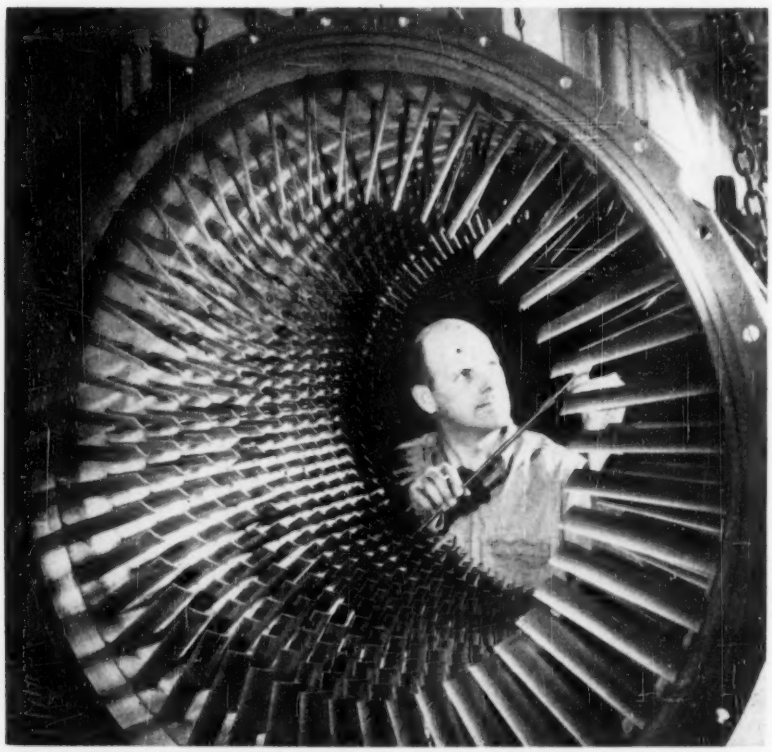
AERODYNAMIC FLUTTER which caused failure of single stage resulted in this grand-scale destruction of axial-flow compressor during NACA test. Stalled blades propagating the flow instability around the wheel may be the contributing cause of this kind of flutter failure.

NACA Pushes Supersonic Thrust Hunt

By David A. Anderton



CLEARANCES ARE CRITICAL between fast-whirling compressor rotor and stator blades. Here NACA technician checks dimensions of stator blades with micrometer. Compressor efficiency depends in part on extremely accurate control of blade dimensions.

Cleveland—Advanced turbojet designs that point the way to tactically effective supersonic aircraft are being tested in component form here at the NACA's Lewis Flight Propulsion Laboratory.

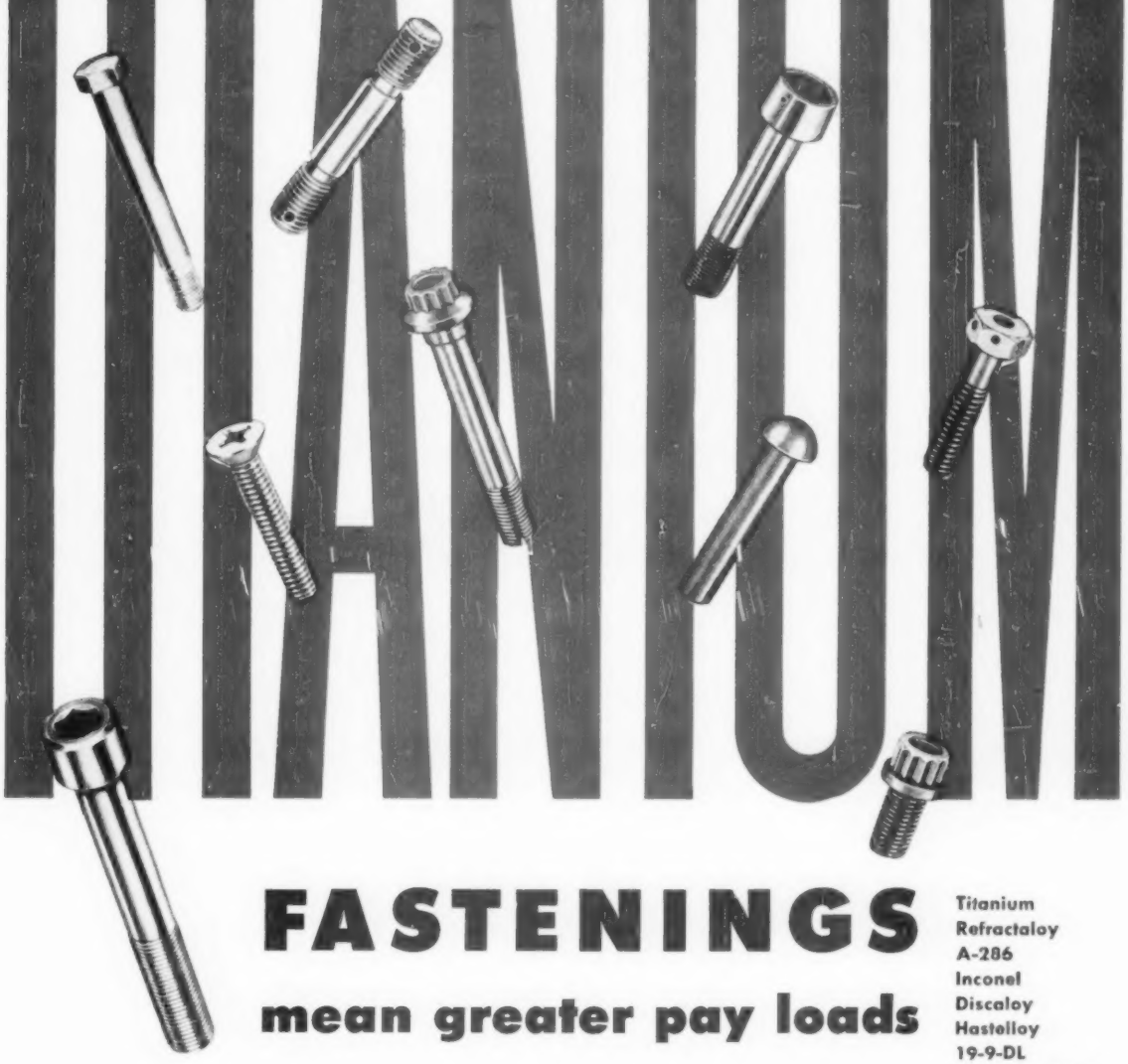
NACA's program is one part of an uncoordinated but extensive engine development effort shared by industry, the military services and government agencies. The final goal is the development of turbojets with the high thrust-weight ratios demanded for supersonic aircraft capable of sustained speeds in the neighborhood of Mach 2 (AVIATION WEEK June 14, p. 12).

Biggest difference so far indicated for these new engines will be in the compressor, but every other component will undergo extensive development to keep up with the requirements of higher thrust. The new compressor will have about half the number of stages commonly used today, and may in some instances have as few as three. Its rotational speed will be about 40% higher.

Combustors will look like today's, but the inner liner will be thinner. The turbine may be a single-stage unit of improved design with hollow blades cooled by air bled from the compressor.

► **Basic Problem**—There is one fundamental premise underlying work on

TITANIUM



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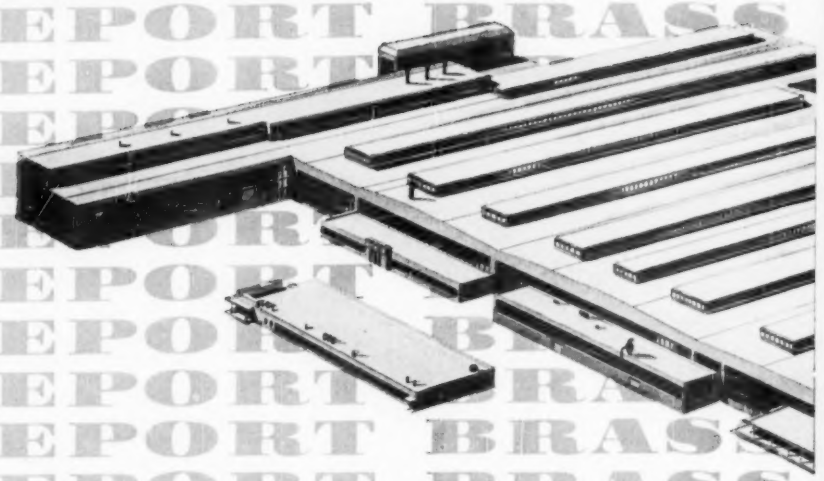
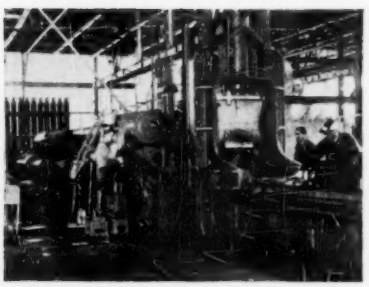
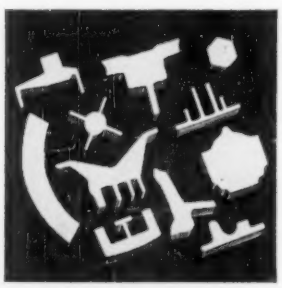


The Adrian, Michigan, Plant of Bridgeport's Aluminum Division—a fully-integrated mill of over 800,000 sq. ft.

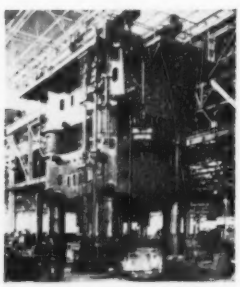
From a Background of 89 Years of Experience in Metals Comes Bridgeport Aluminum



Bridgeport's 16 extrusion presses for light metals production, ranging from 1,650 to 5,500 tons, can make extrusions in many alloys.

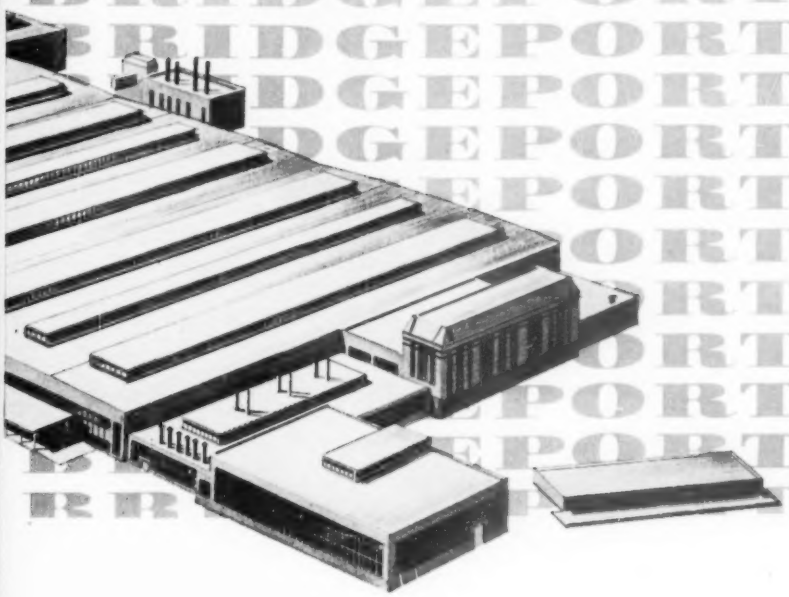


The wide range of extrusions produced by Bridgeport offer unlimited design and production possibilities.



Facilities for producing quality forgings include this huge, 16,500-ton hydraulic press.

BRIDGEPORT



Users of Aluminum Extrusions and Forgings now have a new and highly dependable source of supply—the Aluminum Division of the Bridgeport Brass Company.

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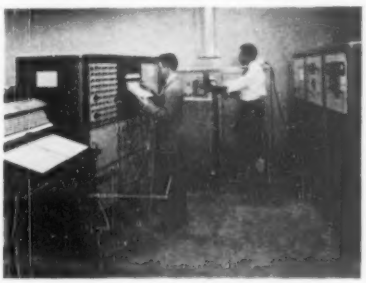

This Quantometer for analyzing metal is typical of the laboratory equipment which assures you the finest quality extrusions and forgings.

Write for your copy of this booklet describing Bridgeport's Aluminum Division facilities.

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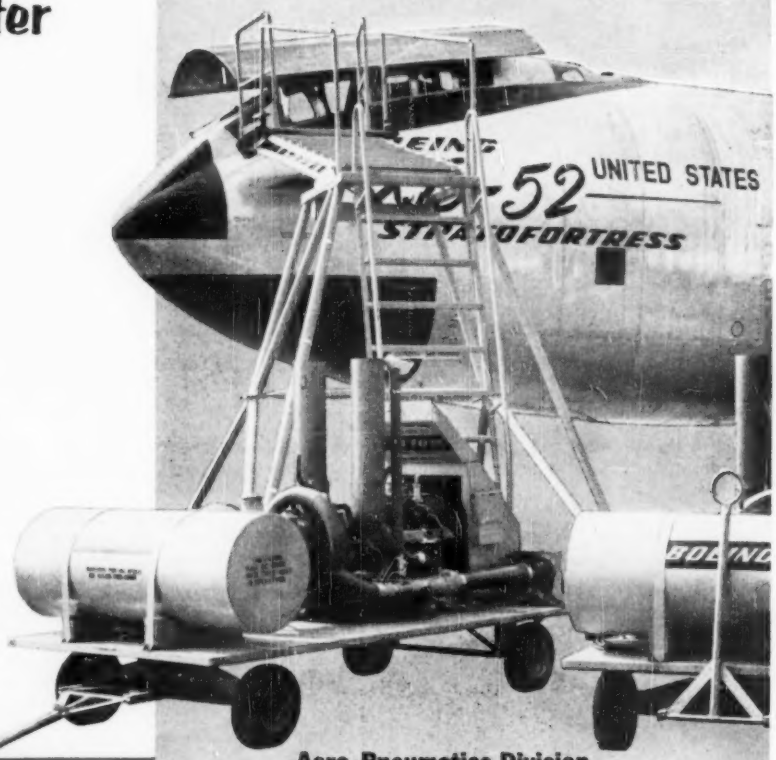
PAC Air Flow Controller helps BOEING save 78% of the WEIGHT of a mighty jet engine starter

...and ups its output 5-fold, too!

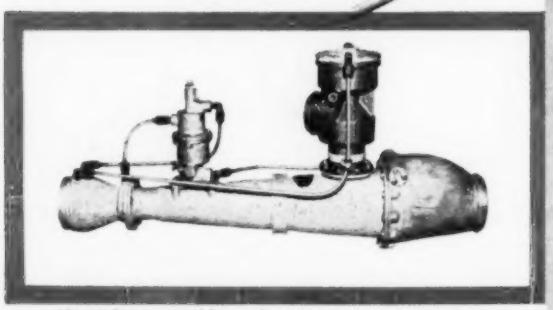
Not so long ago it took a lumbering giant of a machine to start Boeing B-52's. The starter weighed 12,000 pounds, yet for this application provided only a skimpy 57 air horse power.

Today, thanks to brilliant engineering and *the very finest components,* Boeing starts the tremendous Pratt & Whitney J-57 jet engines with a new "air supply cart" which, despite its trim 2600 pound weight, delivers a hard-hitting 280 air horse power! P A C is proud to have had a part in the development of this outstanding jet engine starter through engineering counsel and manufacture of a major component.



An engineered-to-the-job component—vital to the success of the new Boeing unit—is the P A C Air Flow Controller.

This unit is used with a ground air supply system to limit the compressor flow in the event demand falls below a specified minimum. A wide variety of performance curves can be produced with this basic design to match the characteristics of the air supply compressor.



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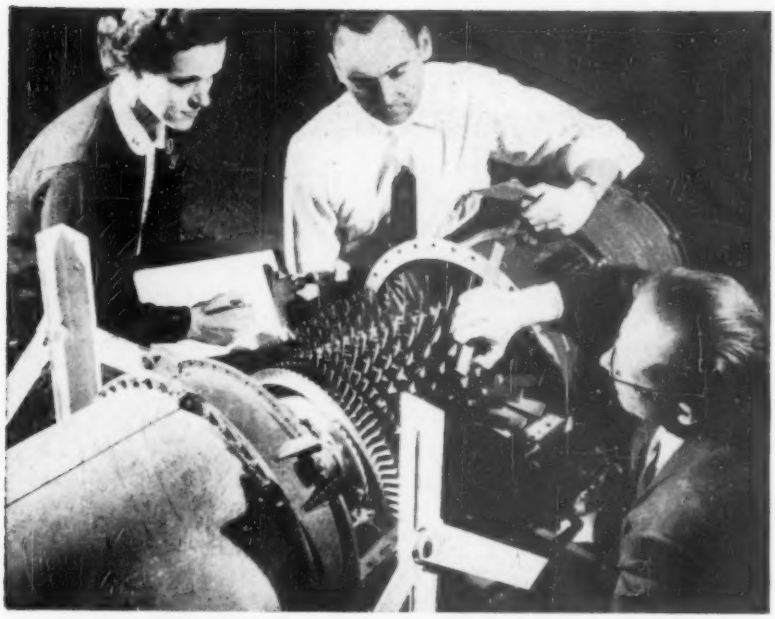


AXIAL-FLOW COMPRESSOR of experimental jet engine is checked prior to test run at Lewis Flight Propulsion Lab, where NACA engineers are amassing information to help designers continue improvement of turbojet powerplants.

such engines: they must be able to produce huge quantities of thrust from a small and light package. But that is not enough; component efficiencies must be high enough or the fuel consumption must be low enough to make the aircraft an effective combat airplane. In other words, the airplane has to have enough range to do the job, as well as enough power to fly at supersonic speeds.

NACA, like other agencies in engine development, is playing the field with studies on turbojets, ramjets and rockets. Of the three, perhaps the turbojet problems are of most immediate interest because of the near-availability of airframes designed for supersonic combat. There are a number of current aircraft designs with supersonic potential, but there are no current production engines available which can make those airframes realize their full potential.

What can be done about that lack? Here are the details of NACA's approach to that important question.

▶**Compressor Studies**—Biggest, heaviest and most complex chunk of the turbojet is its compressor. Its sole task is to pump air through the engine. Double the mass flow of air, and you double the thrust.

So, one obvious way to improve a turbojet is to improve its compressor by making it pump more air. If you can reduce the weight of the big rotating mass while increasing its air-handling capacity, there should be substantial savings. That's the general reasoning behind NACA's several approaches.

One of the first attacks centered on the inlet guide vanes. These are fixed airfoil sections just upstream of the first stage of the compressor, and their function is to direct the air in toward the first stage in the most efficient aerodynamic manner. But on one installation the NACA scientists removed the guide vanes, and the airflow through the engine increased considerably. There also was an increase in the pressure rise but not in proportion to the airflow increase.

▶**Blade Length**—Another approach was to increase the capture area of the engine by increasing blade lengths toward the hub of the engine. This keeps the same outside diameter, but reduces the hub diameter.

NACA parameter for defining the amount of blade length is called the hub-tip ratio, and is the ratio of the hub diameter to that of the blade tip diameter, and is, of course, always less than 1.0. Current turbojet designs have typical values of 0.7 to 0.9; NACA has experimented with blade lengths down to a ratio of 0.3, which represents a practical minimum for hub diameter.

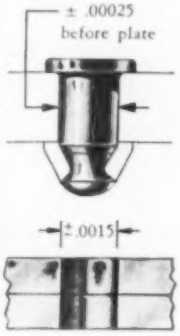
Overall pressure rise across the compressor depends on the number of stages and the pressure rise per stage. If the pressure rise per stage could be increased, than the number of stages—and the weight of the compressor—could be reduced.

The solution to this one is almost obvious, and consists of increasing the rotational speed of the compressor.

By going from a current typical blade speed of 1,000 fps. to the higher

Reversing the usual procedure of inserting a semi-close tolerance fastener into a close tolerance hole—

HS51P-52P series HI-SHEAR rivet with a close tolerance shank, fits into a semi-close tolerance hole, pilot and core drilled.

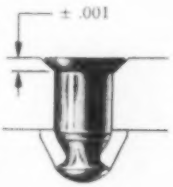


This easier made hole

reduces installation costs

Additional savings are realized in less drilling skill needed, equipment and inspection.

The head shaving operation, to achieve surface smoothness, is eliminated by installing this close tolerance head style HI-SHEAR into a properly prepared countersunk or dimpled hole.



160,000-180,000 psi heat treat—lead chamfer to aid interference fit—cadmium plated after grind to prevent corrosion.

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The hydraulic power unit for the 19" Hydroform is pit mounted to provide unobstructed floor space surrounding the machine. With this arrangement, the machine occupies an area only six feet square at floor level. Machine height above floor level is 11⅓ feet.

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CINCINNATI Hydroform

THE CINCINNATI MILLING MACHINE CO.
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value of 1,400 fps., NACA scientists were able to show a pressure ratio rise from about 1.5 to more than 1.7, about a 15% increase.

▶**Profit and Loss**—These gains in performance bring problems with them. Boundary layer buildup and compressibility shocks tend to drop the compressor efficiency as the tip Mach numbers increase above Mach 0.7. This calls for aerodynamic redesign of the blades.

Longer blades which pass more air bring an increase in blade stresses; they may also develop aerodynamic flutter at off-design conditions.

In investigating the flutter problem, NACA scientists have come up with what they believe is the trigger action in starting the destructive chain reaction of flutter. They have found that a stalled condition develops in a particular portion of the compressor wheel arc, and moves around the wheel in a direction opposite to the rotation. This phenomenon, dubbed "rotating stall" is apparently the cause of flutter.

Tests have shown that as many as 12 separate stall patterns may be acting on the wheel at once. If the frequency of these aerodynamic forces equals the natural frequency of the wheel, resonance sets in and the trouble begins.

There are some solutions available to lick this problem. But NACA says that there are variations in the pattern of rotating stall from engine to engine in a production lot, and this is going to make the answer more difficult to generalize.

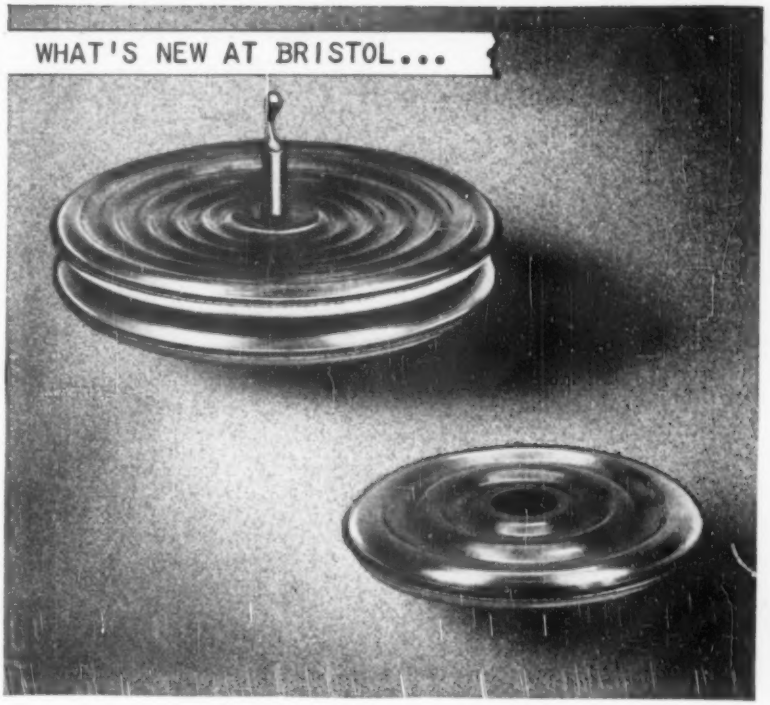
▶**Do They Work?**—During the inspection tour, a test crew ran a compressor of advanced design and of few stages which had been adapted to a regular production turbojet. Qualitative readings of blade vibration were given by an oscilloscope, and the noise level could be judged aurally.

During the acceleration to the design point, the engine ran noisily and the blades were vibrating wildly. But at about 60% of the design rpm., the noise level dropped abruptly and blade vibration calmed down.

The engine was not run to full power during the demonstration; this was because it was a relatively new experimental unit. It had been taken to full power many times, but there was not any point in straining it for the demonstration.

▶**Lighting Fires**—Combustion in a turbojet is generally done with good efficiency, but over a range of inlet conditions which sometimes leaves much to be desired. The flame may blow out at extreme air velocities, or may die out from low pressure in the chamber.

In tomorrow's turbojets, the volume of air passing through a combustor is going to be increased greatly. This will greatly complicate the task of the com-



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The accuracy, repeatability and uniformity of these pressure-sensitive diaphragms are made possible by Bristol's specially developed arc welding equipment, laboratory-controlled heat treating and evacuating processes and the use of the latest leak detection equipment. You can get the diaphragms for pressures of from 1" water pressure, full travel up to 150 psi. Write for more information to The Bristol Company, 130 Bristol Road, Waterbury 20, Conn.

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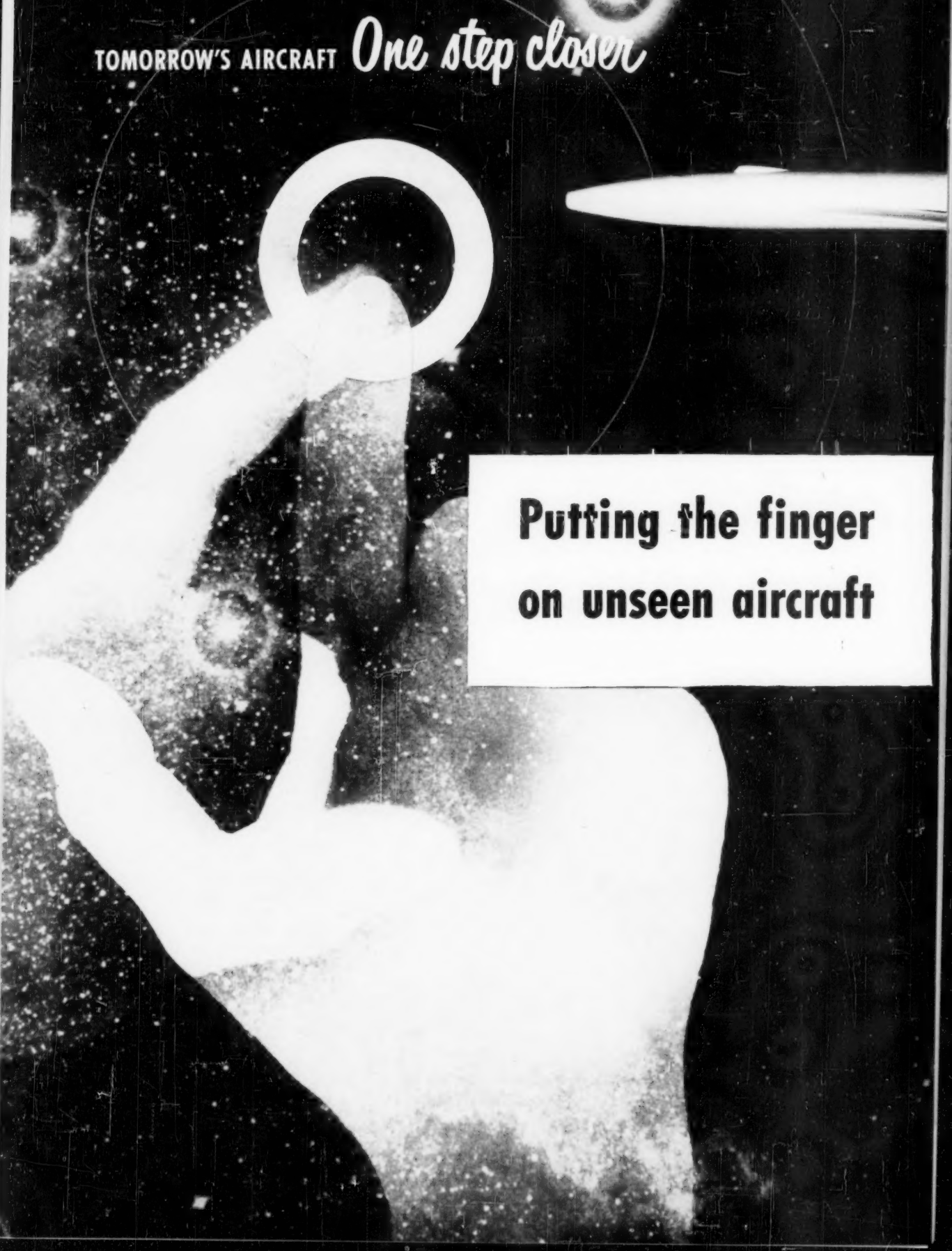
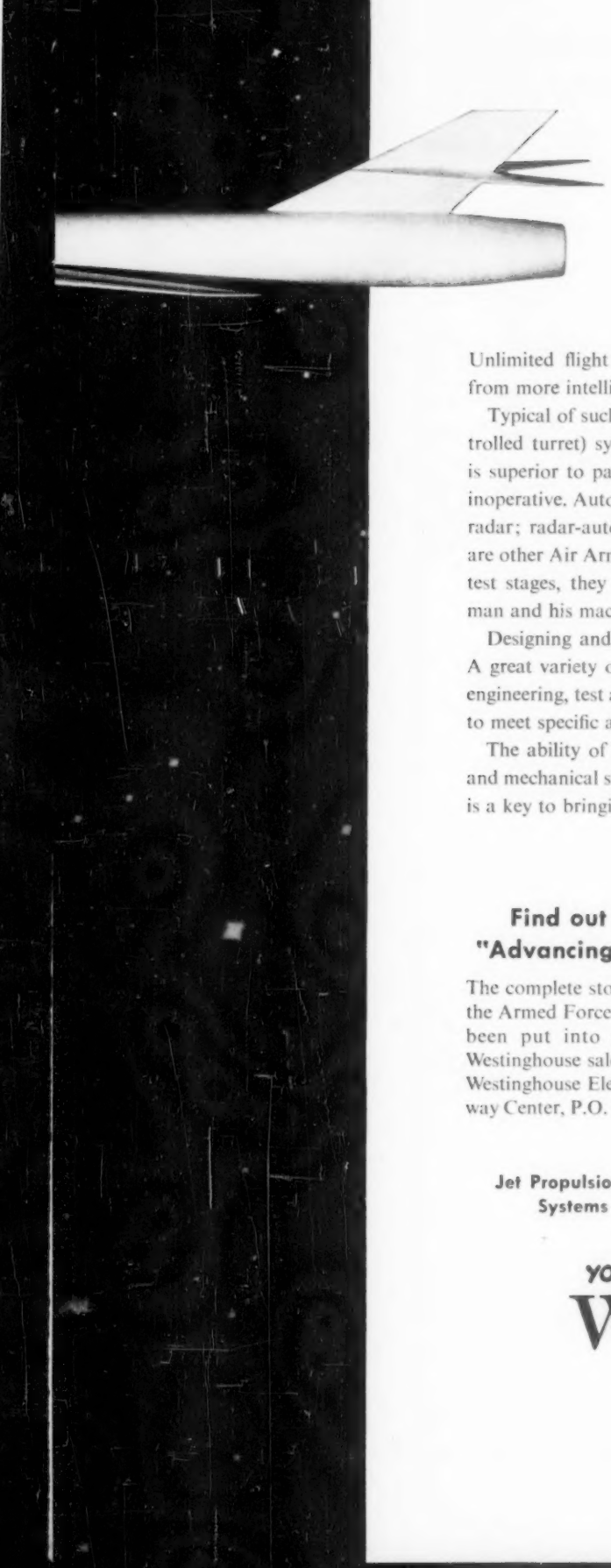
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

TOMORROW'S AIRCRAFT *One step closer*



Putting the finger on unseen aircraft



Unlimited flight and more effective airborne weapons must come from more intelligent airborne systems . . . Air Arm systems.

Typical of such "intelligence" is an Air Arm Defensive (radar controlled turret) system. During "lock-on", its gun dispersion pattern is superior to patterns obtained with the turret anchored and radar inoperative. Automatic lock-on and search-while-track capabilities for radar; radar-autopilot tie-in and automatic low visibility approach, are other Air Arm solutions to automatic flight. Already in final flight test stages, they typify the "intelligence" bridging the gap between man and his machine.

Designing and building this "intelligence" is Air Arm's business. A great variety of products and developments—backed by complete engineering, test and production facilities—are daily finding new ways to meet specific airborne requirements.

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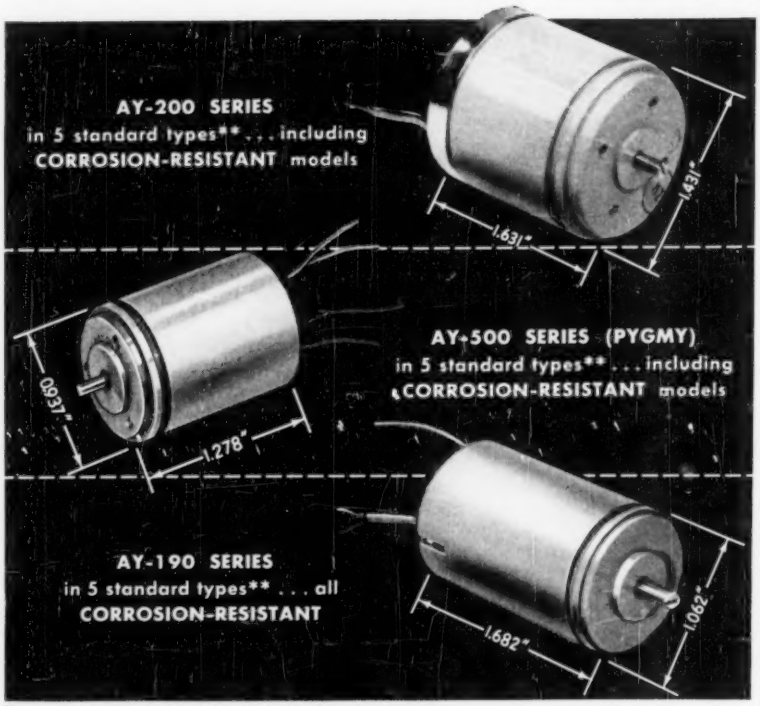

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Our Autosyns provide the perfect answer to synchro requirements for three good reasons. First, they're priced attractively to keep down your initial cost. Second, they can be delivered in prototype quantities *at once*. Third, they're available in all standard types in production quantities . . . as well as practically any special type you could ever need. And, of course, military specifications are used as design objectives in all cases. Only at Eclipse-Pioneer can you find the combination of experience, facilities, and production techniques that make possible all these important advantages. So, *whatever* your synchro requirements, it will pay you to see Eclipse-Pioneer.

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bustion expert. Whatever solution he comes up with will have to be a compromise.

Current combustors in jet engines generally consist of a chamber with an internal liner which is punctured with a series of holes. The inner liner shields the wall of the combustion chamber and also serves as a flame holder. The liner dimensions are critical; make them too small, and the flame will not stay held to the liner. Make them too big, and the pressure drop loss through the chamber is too much to tolerate.

NACA's combustion experts will not go into details, but they have taken the same basic pattern of liner, holes and all, and by rearranging the pattern and adjusting the areas of the holes, they have come up with a liner which meets tomorrow's requirements.

It can handle considerably more than twice the current airflow, and burn at a higher efficiency. There is an increase in pressure drop but it is tolerable and under the figure that had been set as a target maximum allowable.

▶ **Turbine Wheels**—The burned fuel-air mixture blasts out of the combustion chamber and whirls through the turbine wheel, supplying power to drive the compressor and thrust to drive the airplane.

The turbine has to work under trying conditions; whirling at high rpm., it must handle near-incandescent gases at temperatures which melt ordinary steels.

▶ **Two Approaches**—Much of the NACA's work on turbines has been kept under strict security. In general, it is along two lines: materials and cooling.

• **Materials**—Investigations of new metals, ceramic coatings and cermets have been underway at Lewis and at subcontractors to NACA for several years. They are leading to a wider selection of turbine materials for future designs.

• **Cooling.** Turbine cooling offers real advantages, NACA staff engineers believe. By bleeding air from the compressor and routing it through the shaft and out through hollow turbine blades, they can work the blade at a much higher temperature because of the internal cooling.

The reason for these particular investigations is that engine thrust is a function of, among other things, the inlet temperature at the turbine. If you can raise that temperature, you can increase the thrust.

▶ **Other Problems**—There is more to a turbojet than compressor, combustors and a turbine. There are bearings which fret and seize and fail; there are lubrication problems which only synthetic oils can solve. NACA is tackling those smaller components with as much vigor as it is working over the big units.

Bearings, for example, are an evolutionary design item. You can look for

NEW HEADQUARTERS for LONG RANGE FLIGHT

Here beside the long runways of Baltimore's Friendship Airport is the brand new Flight Refueling plant, designed and constructed by Flight Refueling for the development and manufacture of Probe and Drogue refueling systems for the Armed Services.

Now in full operation, this new Flight Refueling facility is turning out in increasing numbers the Probe and Drogue refueling equipment which made possible the first non-stop transatlantic jet flight, the first refueled combat operations and the first jet to jet aerial refueling.

And from the Flight Refueling laboratories new systems of higher capacity and efficiency are being developed.

Aviation can take satisfaction that this new plant—devoted to *long range flight*—is now in full operation.

Flight Refueling, Inc.

FRIENDSHIP INTERNATIONAL AIRPORT

Baltimore 3, Maryland

YOU CAN

Remove and Replace

this self-locking anchor nut

When the removable nut in the NS-109 series is used, installation of anchor base on sub assemblies can be made before chemical cleaning, painting or other surface finishing. Since the threaded locking element can be inserted later, it cannot be damaged or corroded by finishes. The removable nut design also permits easy replacement of the threaded locking element if it should be damaged in service, or if repeated removals make replacement desirable.

NS-109 removable self-locking anchor nut. Meets all envelope dimensions of ANA Standards AN366 and AN362.
WEIGHT: comparable to AN366 and AN362 anchor type nuts.
MEETS: applicable requirements of Spec. AN-N-5 and known requirements of proposed MIL specification on self-locking anchor nuts for torque-out and push-off.
FLOATS: approximately .005 for installation alignment.
SIZES: Available in 8-32, 10-32 and ¼-28 thread sizes.

Manufacturers of self locking anchor nuts and special fasteners

Nutt-Shel

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Telephones: Citrus 4-2191 • Chapman 5-3693

the same kind of bearings, but made of a different material, a new steel that will take the 300F to 500F temperatures at the rotating part.

In general, then, these advances are guideposts along one development road towards tomorrow's jet engines. Put together, the components tested here total an engine which is similar to today's, with one big difference in the compressor and a number of little differences down the rest of the line.

It looks like this: A compressor with a low hub-tip ratio, perhaps as few as three stages, but more probably five, rotating at about 40% higher rpm. Next is a combustor, about the same size as the kind you see today; the liner is no longer, but it is thinner, and the hole pattern and sizes are different. A single-stage turbine, with blades cooled internally, handles the increased flow with improved blade design.

The only remaining problem is how to put that package in an airplane and not ruin its thrust output with a poor installation and high duct losses.

The installation of these advanced engines will be described in a separate article to follow.

PRODUCTION BRIEFING

▶ **Douglas Aircraft Co.** plans to purchase land now occupied by Culver City Stadium to erect an addition to its Santa Monica Division. The addition will include offices, warehouses and light manufacturing buildings.

▶ **Boeing Airplane Co.**, Renton, Wash., is saving an estimated $219,340 and 44,530 man-hours annually using air-driven tools to install nut plates on KC-97 assemblies. Tools are a punch and companion rivet squeeze. Punch is self-centered by a cone placed in the large nut-plate hole. It locates and punches holes in metal up to ⅛-in. thick in one operation without need for auxiliary jigs or positioning fixtures. A special fastener positions the nut-plate and holds rivets in position. The companion rivet squeeze, which fits over the fastener, eliminates need for a rivet bucker.

▶ **Mechaneers, Inc.**, Bridgeport, Conn., has completed 170 special tools to make Piper Apache business plane engine mounts.

▶ **Eclipse Fuel Engineering Co.**, Rockford, Ill., is now producing a full line of DO (diaphragm-operated) solenoid valves designed for aircraft control devices, laboratory instruments and other applications. Valves are for standby control of fluid flow and automatic cycling.

If you
form, bend, or punch metal . . .

Take Advantage
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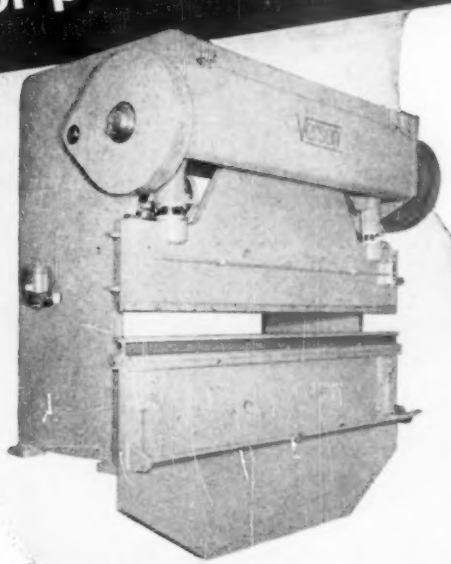
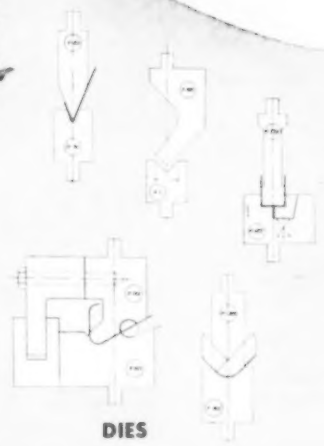


PRESS BRAKES



DIES

TECHNICAL AIDS

Whatever your requirements in press brakes and press brake dies, it will pay you to have full information on Verson's complete service available at all times. Check this list and write for the data you can use:

PRESS BRAKES—The Verson line includes both mechanical and hydraulic models ranging from the 16-48 which will bend 48" of 16 ga. mild steel up to the largest ever built. Included in the line are two standard models available from stock. Catalog B-51 which gives full specifications is available on request.

PRESS BRAKE DIES—The Verson line ranges from the simplest Vee bend dies to the most intricate progressive dies and punching attachments. Over 200 of the most common die sets are illustrated in the Verson Die Manual which is available on request.

TECHNICAL AIDS—Verson technical aids include the 112 page Die Manual which in addition to illustrating typical dies gives much selection and application data available nowhere else. Augmenting the manual is a handy pocket size tonnage calculator which quickly tells the tonnage required for making any bend. Copies of both of these aids can be had by request on your company letterhead.

A Verson Press for every job from 60 tons up.

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LFE and Bendix* unveil SPAR, the first proven low-cost GCA landing system

Northeast Airlines Chief Pilot — Captain George B. Steers, says, "I've been in on only a few of the many test hours flown against SPAR, but I've had perfect performances out of it every time. With its superior accuracy, SPAR has unfailingly brought me right in on the centerline."

NOW every airport can afford to lick the weather

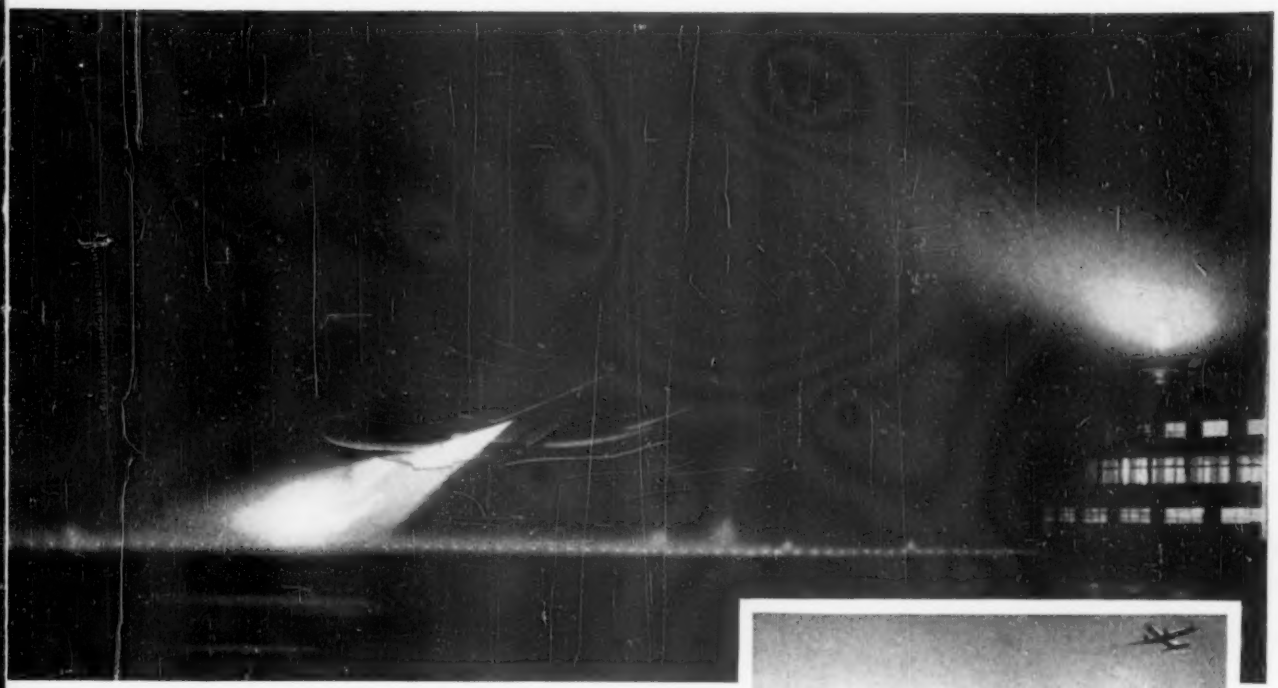
Laboratory for Electronics Announces: — Sensational low-cost, portable SPAR (the Super-Precision Approach Radar) . . . enables every airport to afford a Ground Control Approach system. Already tested and proven, ***SPAR is now in quantity production, ready for definite delivery.***

Look What SPAR Can Do For Your Airport

This new precision approach radar . . . so light and portable that it can be air-lifted by helicopter . . . ***so simple it can be set up in less than two hours and operated by one man*** . . . is the answer for any size airport or airstrip. Now airport income and business lost to your town because of cancelled flights need no longer be a major concern.

SPAR's ease of operation and simple maintenance requirements, ***established in field demonstrations during the past year,*** have amazed civil and military observers. Time after time in test performance, SPAR has brought in all types of aircraft from jet fighters to Convair-Liners to within inches of the runway centerline. ***Yet SPAR sells for ¼ the price of other available instrument landing aids, saves money on operating expense and maintenance.***

Write for Performance Specifications on SPAR and delivery dates. Also, special information for municipal airport managers on how SPAR will pay for itself at your airport. All inquiries from foreign countries should be addressed to: Bendix International Division, Bendix Aviation Corp., 205 East 42nd Street, New York 17, N. Y.



▲ **On Schedule:** SPAR, Laboratory for Electronics' latest electronic development for American business, frees smaller commercial airports from the handicap of "lost business" due to lack of a Ground Control Approach system. SPAR is *high precision* (maximum error, 20 ft. from point of touchdown) and *low cost* (¼ the cost of any other available instrument landing aids). SPAR also costs less to operate, less to maintain.

This is the equipment which first demonstrated and *proved by performance* the practicability of applying light weight, portability, and low cost to a GCA system. Today SPAR is the only such system with a record of actual performance on *the field*. SPAR is ready for your inspection. You can watch it in action, test its proficiency. And LfE can ship SPAR to meet your delivery dates because it now is in quantity production.

LfE SPAR

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* *Trademark of Bendix Aviation Corp.*

SPAR's greatly simplified design brings price within range of all airports, gives both aircraft azimuth and elevation, provides "fail-safe" operation through electronically computed flight paths reflected on high-precision B scan display on field or by remote control in your airport tower. Incorporates all modern developments to permit operation under worst possible weather conditions.

World's First radar system to successfully combine ruggedness and reliability of military equipment with economy of industrial quantity production. SPAR's light weight and easy portability fit all mobile warfare requirements. SPAR can be completely assembled in 6 man-hours and can be reoriented at any time to different runways in less than 10 minutes. The indicator-control unit can be operated from a foxhole or a control tower.

In April 1954, during Operation Boxkite at North Air Force Base, South Carolina, jet fighters made over 300 landings against SPAR.

SUPER SABRE tail design is unusual. Low-slung, razor-thin horizontal surface is all-movable; short vertical tail has small rudder.

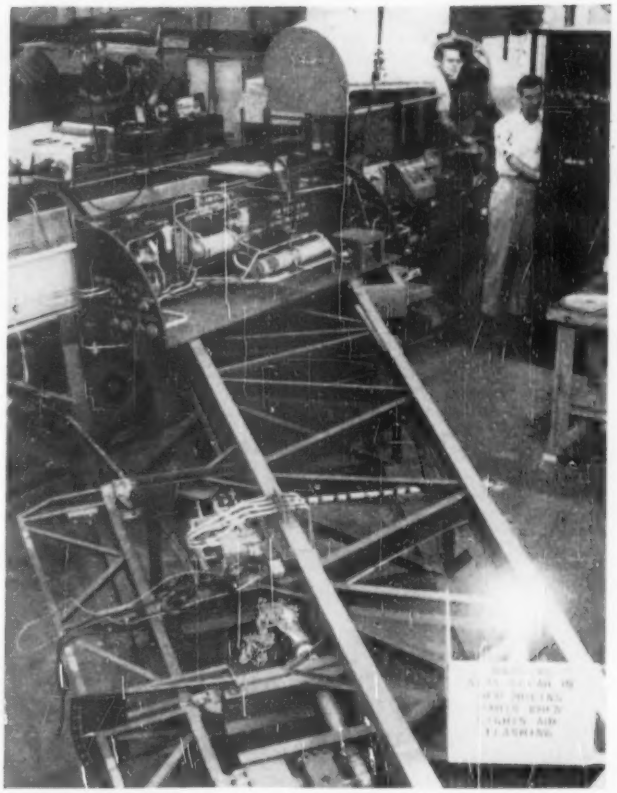
NAA Refines Super Sabre for Supersonic

VERTICAL TAIL is very thin, has been redesigned and lowered in production craft.

DIVE BRAKE is single unit on Super Sabre in contrast to paired brakes on earlier F-86 series. Rugged, nearly flat structure is operated hydraulically.

HORIZONTAL TAIL is all-movable "slab" type; low position on fuselage shows stability advantage at high speed.

NOSE INLET of F-100 is pitot type for high efficiency over entire speed range. Antenna is housed in upper lip.



CONTROL SYSTEM is evaluated on this mechanical-hydraulic test apparatus in laboratory synthesis of full-scale performance.

Performance

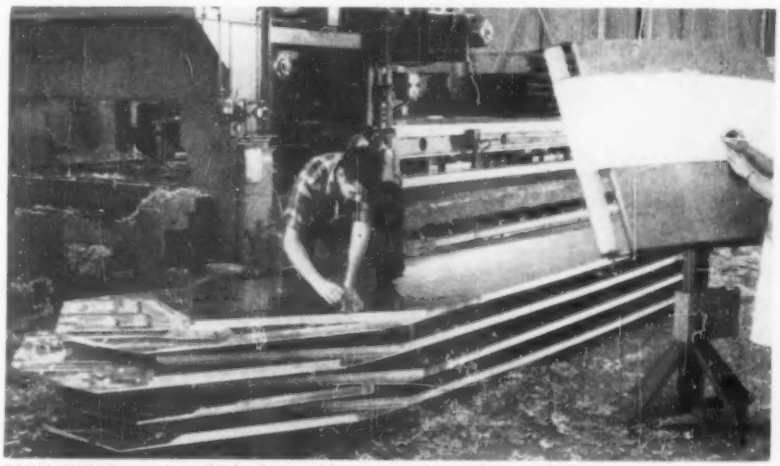
First detailed pictures of North American's F-100A Super Sabre show some of its unusual design aspects required by the demands of supersonic flight.

Most noteworthy is the control system. Horizontal tail is an all-movable surface referred to as the "slab" type, favored by aerodynamicists for speeds above the transonic. It is mounted low on the fuselage, almost in a direct line with the wing, instead of in the high location typifying subsonic practice. Large deflection range of the surface is clearly shown.

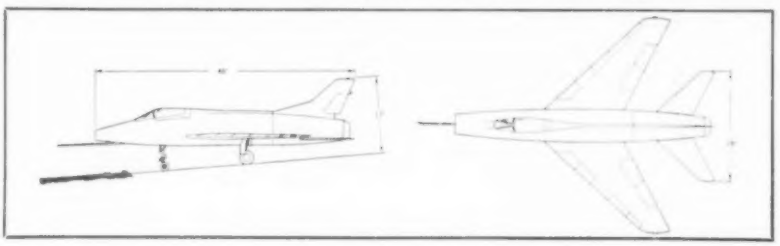
Vertical tail has been redesigned from the high aspect ratio layout of the prototype to a considerably shortened surface; the rudder is much smaller in area than originally.

Lateral control surfaces are located at midspan, and are split spanwise. This may be so that all of the area can be used during lowspeed flight, and only part of it during supersonic flight of the Super Sabre.

F-100A is a day fighter; further developments will be the F-100B all-



THIN WING requires thick skins with structural members milled into the heavy stock. Number of individual fasteners needed is greatly reduced in this structure type.



Aerial assault on disease

Franklin-Powered

Bell Helicopters enlisted for war on malaria in Colombia

Across Colombia's steaming jungles and towering mountains, ten Bell 47G helicopters are waging a lethal dusting campaign against the malarial mosquito. Operating over incredibly rough country, dependability of both aircraft and engines is a crucial need. The world-wide service record of Franklin-powered Bell helicopters, coupled with the Colombian Air Force's experience with five similar ships, dictated the choice for this challenging assignment.

Belt is not alone among helicopters depending on Franklin engine performance. Four out of the five CAA-certificated helicopters under 400 h.p. — over 75% of all the helicopters flying today — are Franklin powered.

We would be happy to talk with you about your aircraft engine needs or about our other specialty — precision machining and assembly on a subcontract basis. Our plant is modern and complete, our engineering and production personnel unusually capable. Immediate capacity available.

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weather version and the F-100C fighter-bomber.

The F-100A has a wingspan of 36 ft., and a length of 46 ft., It is powered by the 10,000-lb.-class Pratt & Whitney J57 twin-spool turbojet.

THRUST & DRAG

". . . The pressure refueling system in a certain aircraft permits refueling of an aircraft in four minutes from a single point. The system also weighs 57 lb., employs six electrical relays, some 350 ft. of electric cabling, three servo valves, three refueling valves, one slide valve, one rotary switch, five toggle switches, 10 signal lights, 10 pressure switches, etc., etc.

"The same job could be done in five minutes using the five standard filler caps fitted to the aircraft with a man holding a fuel nozzle into each. In view of the fact that five filler caps are fitted even with the pressure refueling system, the comparative weight for the five-man system would be zero."

That is an excerpt from an excellent review of the all-weather interceptor by R. N. Lindley, Avro Canada's chief design engineer. He had just finished making a point in favor of the use of manpower at a "superficial inefficiency" in order to keep the penalties to an aircraft to a minimum.

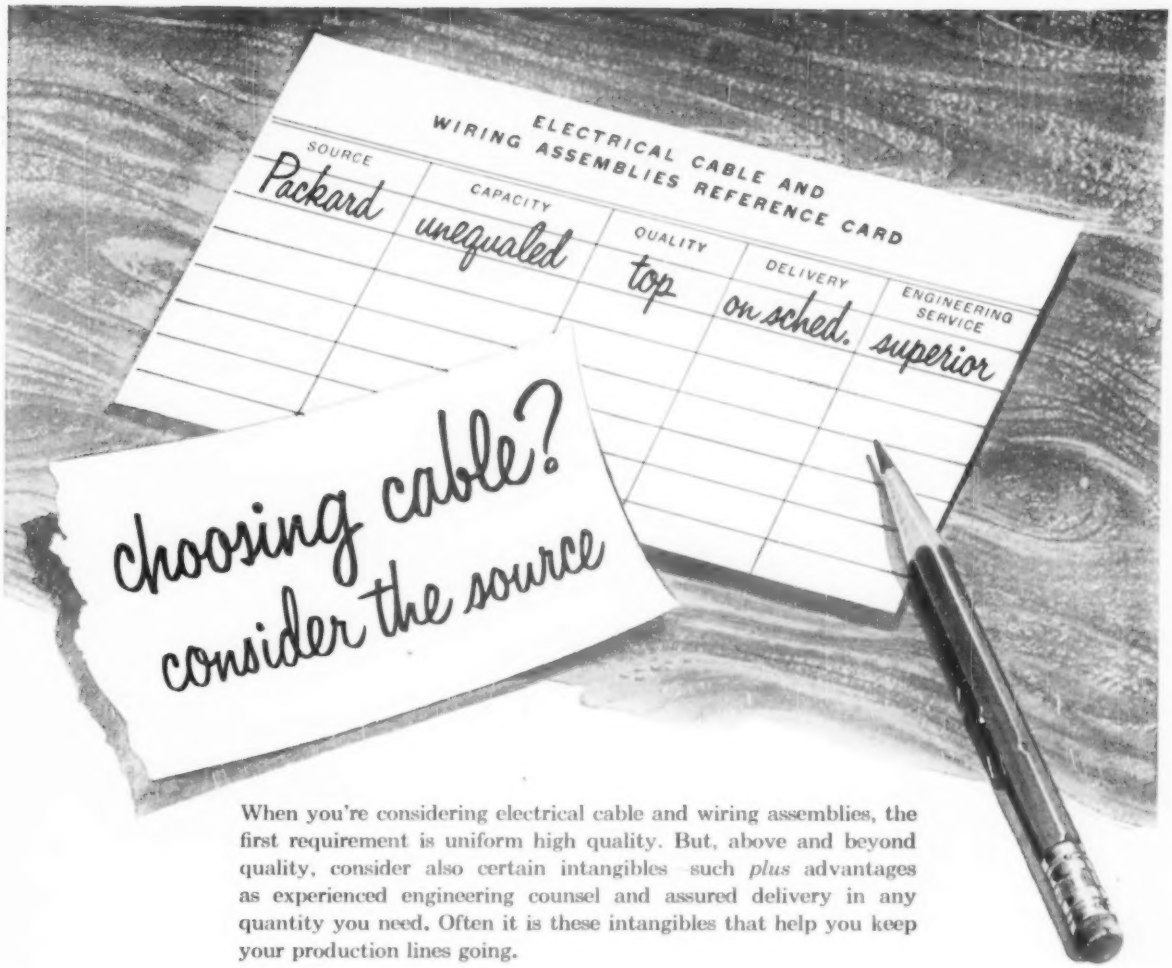
Such use of manpower is something that has been recognized on the other side of the fence for some time. It can make for simplicity in the airplane, at the expense of increased complexity in ground equipment and personnel use.

This is not an argument in favor of replacing machines with men. It is an argument for a second look at any situation where either machines or men could do the job. It is an argument for a careful operations-research analysis to determine final cost of the system.

Sure, we can't be prodigal with manpower, but we can't be prodigal with dollars either. If five airmen for five minutes costs less than 57 lb. of internal workings, and if the extra minutes are available, is there any question as to which system to use?—DAA

Palmdale Warehouse

North American Aviation, Inc., will build an Air Force warehouse costing more than $1.4 million for storing plane production machinery and other equipment at Palmdale, Calif., Airport. Completion is planned for March 1955. The firm has also started erection of a $557,000 building for additional warehousing and office facilities at its Downey, Calif., plant.



When you're considering electrical cable and wiring assemblies, the first requirement is uniform high quality. But, above and beyond quality, consider also certain intangibles—such *plus* advantages as experienced engineering counsel and assured delivery in any quantity you need. Often it is these intangibles that help you keep your production lines going.

Consider Packard as a source

Product *quality*? The wide choice of Packard, by America's foremost manufacturers of automotive vehicles, aircraft and appliances, is your answer.

Capacity and delivery? Packard is equipped to produce more than 7,000,000 feet of finished cable, and 800,000 wiring assemblies, *daily* . . . and to maintain delivery schedules unfailingly.

Engineering service? A large staff of Packard engineers is ready to serve you at any time, at any place. Call on them—the earlier, the better, preferably while your new product or model is still on the drafting board. Our engineering counsel has often effected important savings in assembly costs.

Packard

TRADE MARK

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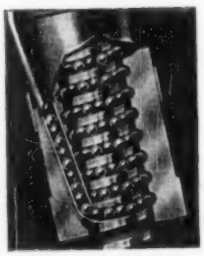
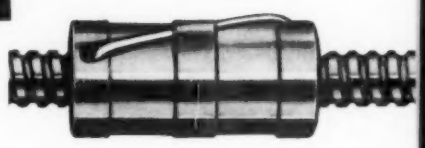
BOEING···first in je

VARD···first in mechanical actuation

VARD BALL SCREWS— the most efficient means known for transmitting rotary to linear motion— are utilized to actuate the flaps of the new Boeing 707. VARD is proud to have participated in the design and production of important components in this forerunner of American jet transports.

a production mode





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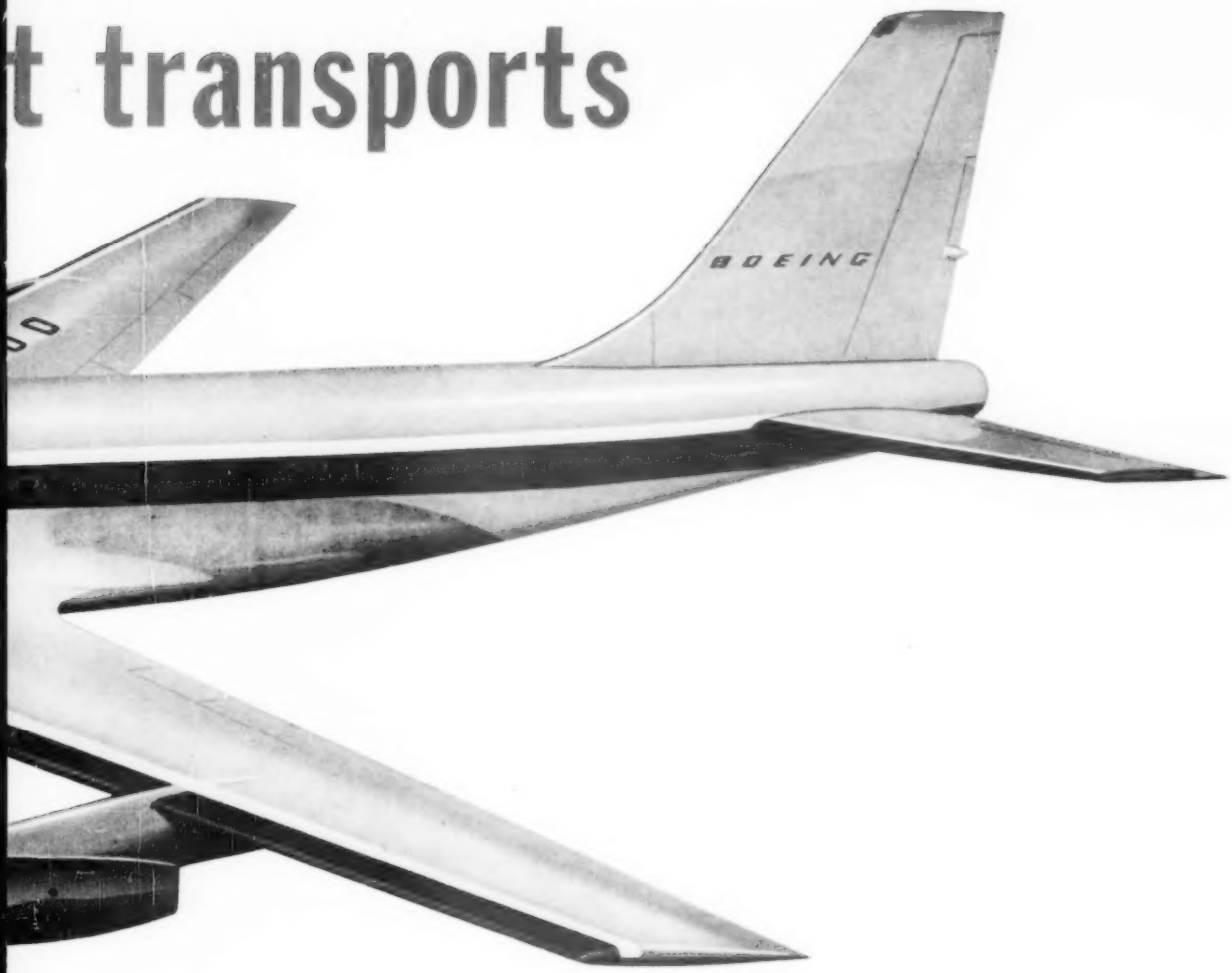
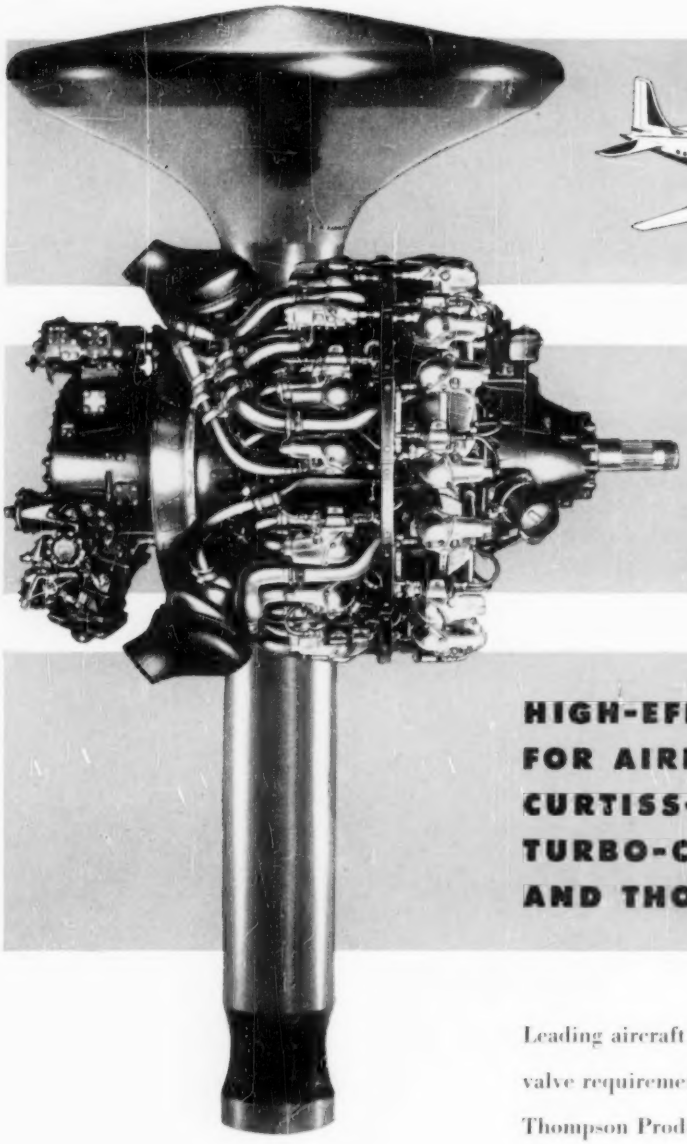


of the Boeing 707 Stratotanker-Stratoliner would be capable of high-speed, high-altitude refueling of existing and future jet fighters, bombers and other combat aircraft.

ard INC PASADENA 8 CALIFORNIA

SPECIALISTS in Rotary-Linear Actuation for the Aircraft Industry



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Leading aircraft engine builders bring their valve requirements and problems to Thompson Products... leader in research, development and production of valves for all types of internal combustion engines.

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VALVE DIVISION

Thompson Products, Inc.

DEPT. VC-64 • CLEVELAND 17, OHIO

SEVEN CRATES carry Martin Matador's basic components. Boxed are the fuselage's nose, center and aft sections, the wing, fin, stabilizer and instrumentation.

POSITIONED for assembly, parts are lined up opposite their connection stations.

UNCRATED COMPONENTS are laid out for put-together. Wing panels fit into center section carry-through opening. Stabilizer is in foreground; fin, top left.

MATADOR IS FIRED from its mobile launcher. Booster drops off when expended.

Matador Packaged for Fast Field Assembly

Study of the Martin Matador points up the refinement of the design-manufacturing-logistics relationships of the pilotless bomber.

The B-61, in effect a large ground-to-ground missile, incorporates a breakdown scheme establishing seven basic components and installations for easy shipment and fast assembly of the combat article in the field. Also stressed in the Matador's makeup are simple manufacturing techniques in keeping with the expendability of the weapon (AVIATION WEEK Oct. 5, 1953, p. 28).

▶ **Crating Scheme**—There is no final assembly line operation in the manufacturing program. Instead the configuration is left broken down into seven major parts—the nose, center section, aft section, wing, fin, stabilizer, and instrumentation.

These components are weatherproofed and packed in compact crates for easy and fast shipment to forward positions or training grounds. The components are not assembled until just before it is desired to launch the missile. The major components are interchangeable, which means that a specific set of assemblies need not comprise any particular complete weapon.

▶ **Firing, Dimensions**—Matador is easily fired from a mobile launcher just about as long as the missile itself and narrower than the wing spread. Elevated to the launching angle, the missile takes off, its Allison J33 turbojet powerplant aided by a powerful rocket booster. This Rato bottle drops off as soon as its power is exhausted.

This missile is reported to be 30 ft. long, 4½ ft. in diameter. Takeoff weight is tagged at 12,000 lb., range 500 mi. (AVIATION WEEK Mar. 15, p. 80). Diving on its target, the missile exceeds sonic speed.

▶ **Producibility Factors**—As the two assembly photos reveal, the conection of the wing panels is facilitated with two large center splice castings—one at each panel's root end—hooked up by bolting. The wing skin of each panel is bonded to the as-cast surface of the casting. This scheme eliminates mechanical connection between the parts. Thus, it cuts down on weight, increases producibility.

If bolts are used to attach the skin to the casting, about 425 would be required. With the bonding scheme, the center splice casting is bonded to the skin at the same time that the skin is bonded to its honeycomb core.

The stabilizer incorporates a single-

piece center aluminum casting to which the skins are bonded.

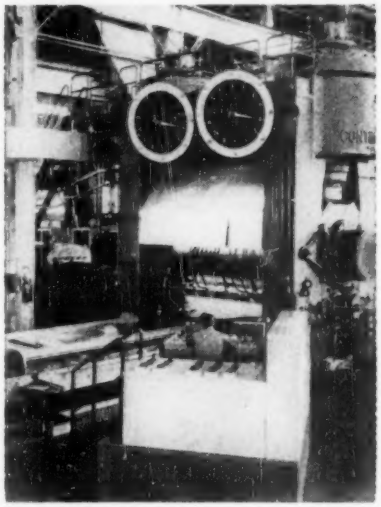
Honeycomb core is used in the stabilizer as well as the wing. This core material is contoured quickly with a bandsaw. A single pass of the metal core past the bandsaw blade cuts it to the desired shape.

Giant Taper Mill Starts Production

A huge tapered sheet and plate rolling mill at the Aluminum Company of America's Davenport, Iowa, plant is in production turning out 10-ft.-wide aluminum alloy wing skin material (AVIATION WEEK Feb. 4, 1952, p. 47). Length of this tapered sheet stock reaches to a maximum of 40 ft., with 1¼-in. maximum thickness at the heavy end.

The rolling mill and some auxiliary equipment have been supplied to Alcoa under a lease arrangement with the Air Force. Alcoa built two new buildings to house the 52,000-sq. ft. operation. The company has additional production equipment needed for use with the new Air Force mill.

To meet production requirements for longitudinally tapered material with multiple tapers and material with transverse tapers, Alcoa is installing a large milling machine capable of machining plates 10x40 ft., and a 7x40-ft. taper grinder. This equipment also is under lease arrangement with the Air Force.

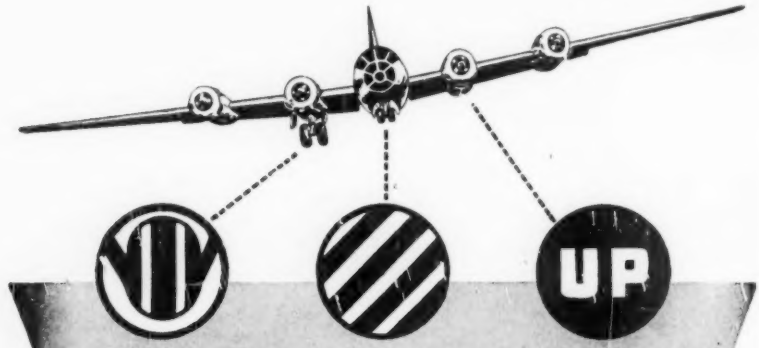


TAPERED aluminum alloy stock 40 ft. long is produced on Alcoa machine.

Robins AFB Awards

The following contracts were recently announced by the procurement office of Robins AFB, Macon, Ga.:

- **A. C. Spark Plug Div.**, Flint 2, Mich., kit assys., 7,837 ea., $45,550; kit, replacement of internal ring gears, 1,518 ea., $359,638; kits, 5,805 ea., $59,765.
- **A. C. Spark Plug Div.**, Milwaukee, Wis., kit, replacement of cover assy., 787 ea., $147,169; kit, 11,098 ea., $228,914; kit, 1,909 ea., $33,521; kit, 1,023 ea., $40,166; kit, 1,854 ea., $332,159.
- **Air Products, Inc.**, Emmaus, Pa., liner cylinder, 104 ea., plate valve, 96 ea., crankshaft assy., $26,541.
- **Brunson Instrument**, Kansas City, Mo., theodolite, Brunson model #50, 53 ea., $26,182.
- **Budd Co.**, Detroit 15, wheel assy., 1,670 ea., nut cap, 27,720 ea., $50,000.
- **Cardox Corp.**, Chicago 1, nozzle bayonet, 126 ea., kit gage, 100 ea., valve hydraulic, 118 ea., $75,134.
- **Clark Equipment Co.**, Benton Harbor, Mich., power takeoff, 10 ea., takeoff and clutch assy., 16 ea., roller, 174 ea., $29,054.
- **Coates Elec. Mfg. Co.**, Seattle 4, furnace, incr., $33,292.
- **Continental Motors Corp.**, Muskegon, Mich., engine assy., 60 ea., $113,278.
- **Crown Machine & Tool Co.**, Fort Worth 7, Tex., machine, plastic injection molding, 3 ea., $30,471.
- **Curtiss-Wright Corp.**, Caldwell, N. J., overhaul of 1,200 propellers, $1,171,992; propeller spare parts, 1,128 ea., $695,717; cuff, 10 ea., brush, 1,061 ea., gear assy., 2 ea., $50,854.
- **W. S. Darley & Co.**, Chicago 12, valve assy., 156 ea., cup clutch, 226 ea., shaft drive, 378 ea., $37,629.
- **DeVilbiss Co.**, Toledo, compressor 93 ea., $43,893.
- **General Electric Co.**, Johnson City, N. Y., scale-navigation drift, 165 ea., support assy., 42 ea., gear, motor mating, 286 ea., $154,013; link assy., 499 ea., chute assy., 7 ea., 4 ea., $124,005; corrective maintenance kit, 191 ea., $160,700.
- **General Mills, Inc.**, Minneapolis, kits, 700 ea., $87,448.
- **General Motors Corp.**, Detroit 2, distributor, ignition, 538 ea., generator, 88 ea., motor assy., 4,382 ea., $159,618.
- **General Motors Corp.**, Dayton, Ohio, kit



Three "pictures" tell the tale . . . Simply, Accurately!

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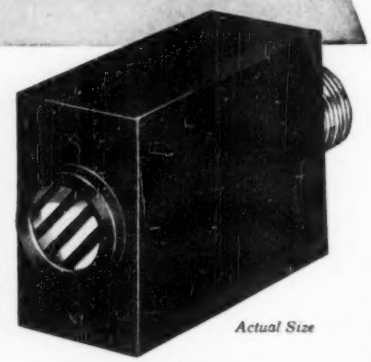
Requires but a Small Space —Gives a "BIG PICTURE" on Operating Conditions

The landing gear markings shown above are but *one* of *eleven* different instrument applications. Tells the story "at a glance" on *flap positions, oil pressure or temperature, fuel supply* and other operating conditions. Economical, easy-to-install in both small and large planes.



Actual Size

High Quality Construction

- Impervious to dust, moisture, gases
- Hermetically sealed brass case
- Filled with inert gas
- Optically clear glass window
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RIVERSIDE

For additional information, write to

KEYSTONE WATCH CASE DIVISION
RIVERSIDE METAL CO.
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Industry Please Note!

NEW METH... NEW PROCUREMENT ARRANGEMENTS.

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BULLETIN.....BULLETIN.....BULLETIN.....

ON 16 AUGUST, 1954, THE MAGAZINE AVIATION WEEK WILL PUBLISH THE COMPLETE STORY OF AIR FORCE PROCUREMENT..."THE AIR MATERIEL COMMAND EDITION," INCLUDING A SPECIAL REPORT ON RESEARCH AND DEVELOPMENT.

THIS EDITION IS OF SIGNIFICANT IMPORTANCE NOT ONLY AS A REFERENCE WORK FOR THE INDUSTRY AND AIR FORCE, BUT IN ADDITION WILL BE OF THE GREATEST POSSIBLE VALUE TO ALL THOSE AIDING IN THE NATIONAL DEFENSE EFFORT.

THE EDITORIAL EXPERIENCE OF THE TECHNICAL AND NEWS SPECIALISTS OF THE AVIATION WEEK STAFF--THE LARGEST SERVING THE INDUSTRY--IS RECOGNIZED THROUGHOUT THE AERONAUTICAL WORLD. THIS RECOGNITION IS YOUR GUARANTEE OF A RECORD ISSUE IN TERMS OF USABILITY AND LASTING REFERENCE VALUE.

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Aviation Week

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USS Carilloy passes rigid

THESE HIGH QUALITY aircraft propeller hubs are forged and machined from semi-finished Carilloy 4340. They meet extremely tough magnaflux requirements.

FOR BIG PROPELLERS, 2 forged sections (**a**) are welded together to form one blade thrust member. Pieces are then ground and magnafluxed. Kellered, ground, and magnafluxed again (**b**). Mill camber sheets (**c**) then are copper brazed to the thrust members. Entire unit is heat treated and polished before final magnaflux test and cadmium plating. Rigorous magnaflux testing assures that every finished blade (**d**) can withstand the tremendous stresses encountered on the latest high-speed planes.

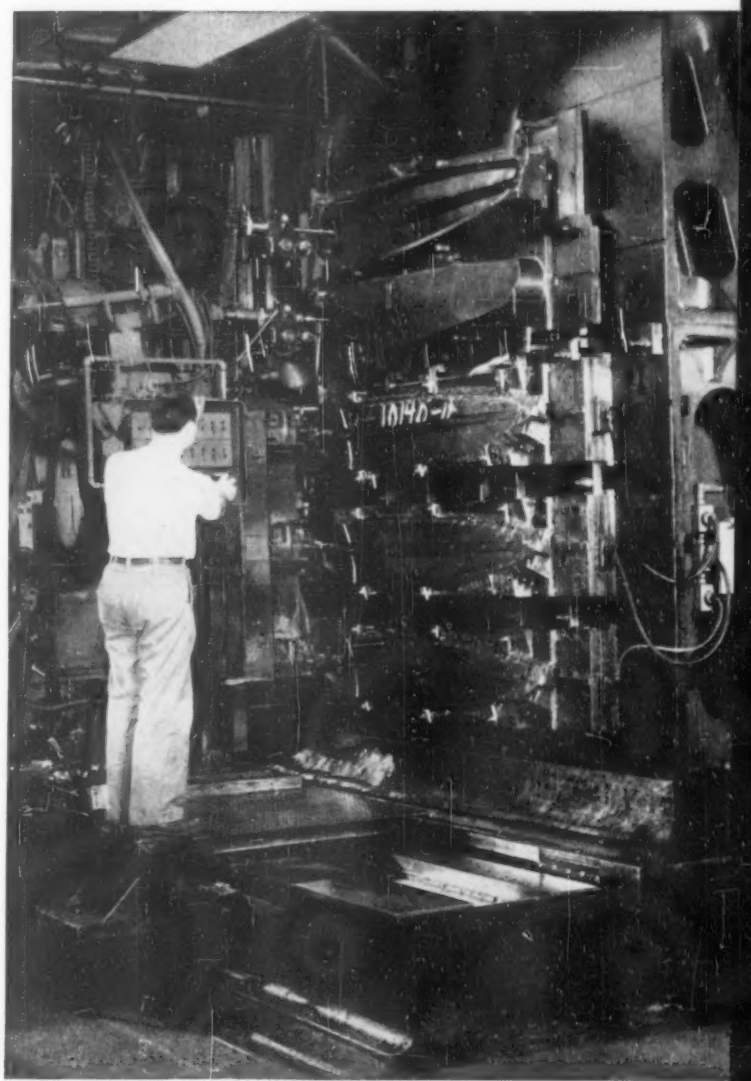
steel tests for propeller blades

AN important manufacturer of propellers for military aircraft has found that in stringent magnaflux tests, USS Carilloy steel performs completely satisfactorily.

The high stresses in propeller blades and hubs naturally require extremely high quality steels. Accordingly, the U.S. Army and U.S. Navy have set up rigid quality specifications requiring that every heavily stressed part must be magnafluxed several times during its production.

With USS Carilloy 4340 electric furnace aircraft quality steel, this important manufacturer is able to count on the performance required for this severe application. The consistent high quality of USS Carilloy aircraft steel has meant greater savings to this customer through minimum magnaflux rejections of costly fabricated parts.

USS Carilloy steels have established an enviable record for meeting the highest quality requirements. Therefore, when you need a standard AISI analysis or a special steel for an unusual application, it pays to call in a USS Service Metallurgist. He can help you solve any steel problem.



AFTER FORGING AND MILLING, 750-lb. thrust sections are hogged out on this Kellering Machine. Finished sections weigh about 155 lbs. USS Carilloy steel maintains a No. 1 quality position on these heavy-duty parts.

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
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Carilloy USS Steels

ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

4-885

UNITED STATES STEEL

assy., 2,646 ea., lever governor, 264 ea., piston and cylinder, 264 ea., $654,884; spacer, 3,000 ea., kit assy., 1,500 ea., $71,493.

• **Heil Co.**, Milwaukee, ladder assy., 176 ea., carrier, 354 ea., guard, 1,042 ea., $59,676.

• **Hercules Motors Corp.**, Canton 2, Ohio, engine, gasoline, 130 ea., $518,675; engine assy., 195 ea., $595,553; cylinder block assy., 20 ea., crankshaft assy., 50 ea., cylinder block assy., 25 ea., $36,867.

• **Hobart Bros. Co.**, Troy, Ohio, welder, 155 ea., $60,011.

• **Homelite Corp.**, Port Chester, N. Y., tank, fuel, 102 ea., container assy., 244 ea., 151 ea., $26,965.

• **Hughes Tool Co.**, Culver City, Calif., kits, 3,321 ea., $74,341; kits, 742 ea., $192,539; kits, 1,242 ea., $1,437,780; reflector antenna, gear bevel, steel, 1,000 ea., antenna cam-antenna drive, 500 ea., steel, 300 ea., $142,123; work on 100E-4, and modification and work on an additional 35 new E-4 fire control systems, with specs., changes, $641,250; kit assys., 2,328 ea., $51,396.

• **International Business Machines Corp.**, New York 22, kits and spare parts, 283 ea., $99,239; kits and spare parts, 1,864 ea., $85,153; kit assys., 528 ea., spare parts, 528 ea., $40,581; kit assy., 452 ea., spare parts, 452 ea., $51,967.

• **Johnson Fare Box Co.**, Chicago, harness assy., gun charger, 628 ea., chain roller, 836 ea., $49,874.

• **K-D Lamp Div.**, Cincinnati 10, light, 15,484 ea., $27,007.

• **Kearney & Trecker Corp.**, Milwaukee, milling machines, 13 ea., $215,108.

• **R. G. LeTourneau, Inc.**, Longview, Tex., hoist, electric, 36 ea., $70,164.

• **Lycoming Div.**, Williamsport, Pa., engine assembly, 190 ea., $301,357; engine assy., 156 ea., $251,920.

• **Manley Div.**, York, Pa., spreader, 293 ea., $26,147.

• **Glenn L. Martin Co.**, Baltimore 3, modification of flight control units and spare parts, 130 ea., $137,995; kits, 67 ea., spare parts, 2 ea., $57,485.

• **Milwaukee Valve Co.**, Milwaukee, valve assy., 296 ea., strainer section, 1,050 ea., coupling assy., 6,480 ea., $51,986.

• **Motorola, Inc.**, Chicago 51, kits, 623 ea., spare parts, 623 ea., $280,034; kits, modification, 1,000 ea., $27,500; kits, 750 ea., spare parts, 75 ea., $36,935; kits, 536 ea., spare parts, $38,777; line balancing network and spares, 623 ea., $45,606; kits, 703 ea., spare parts, 703 ea., $30,692; kits, modification, 750 ea., $90,750.

• **National Cash Register Co.**, Dayton 1, converter assy. kit, 189 ea., computer assy. kit, 190 ea., amplifier assy. kit, 171 ea., $147,656; kit, 127 ea., $35,210.

• **Ohio Machine & Tool Co.**, Kenton, Ohio, drilling machine, 676 ea., $53,742.

• **Parker Appliance Co.**, Cleveland 12, machine, flaring and beading, 18 ea., $29,659.

• **Queen City Mfg.**, Cincinnati, glass, 1,648 ea., retainer, 788 ea., frame assy., 32 ea., $36,688.

• **Rockwell Mfg. Co.**, Pittsburgh 8, meter assy., 1,456 ea., $535,582; rotor meter appl., 407 ea., body meter appl., 149 ea., van rotor appl., $47,437.

• **Samuel Eastman Co.**, Concord, N. H., gun turret, 98 ea., $47,585.

• **Signode Steel Strapping Co.**, Chicago 47, machine, stretching, 20 ea., $53,909.

• **Singer Sewing Machine Co.**, New York, machine, sewing, 146 ea., $73,379.

• **Sperry Gyroscope Co.**, Great Neck, L. I., N. Y., kits, 733 ea., spare parts, 733 ea., $42,443; kits and spare parts, 1,430 ea., $31,016; kits and spare parts, 677 ea., $129,644; kits and spare parts, 781 ea., $112,160.

• **Standard Steel Works**, North Kansas City, Mo., packing ring appl., 3,550 ea., nut and sleeve assy., 724 ea., valve assy., 418 ea., $51,406.

• **Tumpane Co. of Georgia**, overhauling and reconditioning of class 17A equipment, 23 line items, $29,468.

• **Van Norman Co.**, Springfield 7, Mass., universal milling machine, 20 ea., $125,525.

• **Waltz Furnace Co.**, Cincinnati 6, furnace plus data, 25 ea., $57,931.

• **Western Electric Co.**, Winston Salem, N. C., kits, replacement, 2,315 ea., $76,395; APA systems, 11,650 ea., $369,139; kits, modification, 545 ea., $65,945.

• **Worthington Corp.**, Atlanta, crankcase compressor, 498 ea., valve assy., 996 ea., unloader assy., 700 ea., $87,252.

Fast Writeoffs

Accelerated tax amortization for manufacturers expanding their defense facilities is granted by the government in the form of certificates of necessity.

In the following list of recent certificates, company name is given, followed by product or service, cost of construction deemed necessary for defense expansion, and the percentage of the expansion cost allowed for fast writeoff. Fast writeoff permits property to be depreciated in five years.

• **United Tool & Die Co.**, West Hartford, Conn., aircraft components, $133,315, 60%.

• **Piqua Engineering, Inc.**, Piqua, Ohio, aircraft parts, $22,570, 70%.

• **Hamilton Standard Div., United Aircraft Corp.**, East Windsor, Conn., aircraft parts, $738,000, 60%.

• **Hughes Tool Co.**, Culver City, Calif., aircraft parts, $49,400, 60%; $83,350, 60%.

• **Solar Aircraft Co.**, San Diego, Calif., aircraft engine parts, $92,600, 55%.

• **Lockheed Aircraft Corp.**, Burbank, Calif., aircraft and parts, $92,588, 60%.

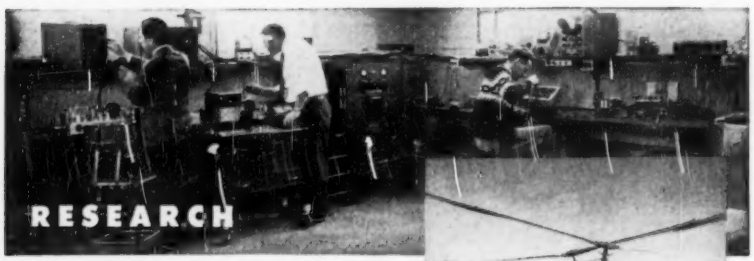
• **Scheidl Mfg. Co.**, Lindenhurst, N. Y., plastics for military aircraft components, $67,500, 45%.

• **Vahl Engineering Co.**, Brooklyn, N. Y., aircraft components, $2,920, 70%.

• **Eaton Manufacturing Co.**, Battle Creek, Mich., aircraft parts, $296,180, 65%.

• **Motor Wheel Corp.**, Lansing, Mich., aircraft parts, $129,203, 65%.

• **Flight Equipment and Engineering Corp.**,



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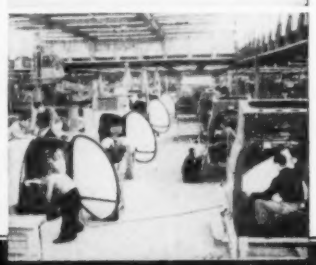
PRODUCTION

To design and develop such outstanding helicopters as the HTK-1 and the HOK-1, Kaman Aircraft has assembled a complete engineering staff skilled in the fields of mechanical design, electronics, aerodynamics with special emphasis on the development and production of electro-mechanical devices and systems. Moreover, the production of Kaman helicopters requires large plant facilities and an impressive inventory of machine tools and equipment from the smallest electronics part to presses of huge capacity. Each contributes to Kaman Performance, and . . .



all are a part of

KAMAN

Miami, Fla., aircraft parts, $159,350, 45%.
• **Ex-Cell-O Corp.**, Lima, Ohio, aircraft parts, $14,000, 65%.
• **Carlton Forge Works**, Paramount, Calif., aircraft and ordnance forgings, $33,188, 70%.
• **McDonnell Aircraft Corp.**, St. Louis, Mo., aircraft parts, $2,450,000, 60%.
• **Carl Tenk**, dba. Tenk Machine and Tool Co., Cleveland, Ohio, special experimental tooling for aircraft, $67,254, 70%.
• **Pioneer-Central Div., Bendix Aviation Corp.**, Davenport, Iowa, aircraft parts, $59,424, 65%.
• **Spartan Aircraft Co.**, Aviation Service Div., Tulsa, overhaul, conversion and test of aircraft and parts, $101,035, 60%.
• **Monument Engineering Co., Inc.**, Indianapolis, aircraft parts, $6,428, 70%.
• **Spolar Bros. Tool Corp.**, Penndel, Pa., machining of parts and tools for aircraft, $75,033, 60%.
• **Flour City Ornamental Iron Co.**, Minneapolis, aircraft parts, $50,040, 65%.
• **Empire Tool Products, Inc.**, East Garden City, L. I., N. Y., aircraft parts, $8,825, 70%.
• **Ryan Aeronautical Co.**, San Diego, Calif., aircraft components, $44,329, 65%.
• **Anderson, Inc.**, Chicago, aircraft parts, $29,129, 70%.
• **E. C. Styberg Engineering Co.**, Racine, Wis., $39,019, 70%.

Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

John Addison Footwear, Inc., 84 Chestnut St., Marlboro, Mass., leather shoes, 7,400 pr., $41,440.
Adel Div., General Metals Corp., 10777 Van Owen St., Burbank, Calif., valve assy., hydraulic, 366 ea., $46,589.
Aerial Machine & Tool Corp., 38-27 30th St., Long Island City, 1, N. Y., cable assembly, $109,961.
Air Associates, Inc., Teterboro, N. J., parts for overhauling of various aircraft, $26,930.
AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, Calif., actuator and maintenance parts for S2F-1 aircraft, $35,216; hot wheel assy., 150 ea., $194,910; actuators and spare parts for same, 494 ea., $91,651.
Bertea Products, 1450 N. Lake Ave., Pasadena, Calif., valve assy., hydraulic, 852 ea., $41,458.
Breeze Corps., Inc., 41 South 6th St., Newark 7, N. J., lead assy., $200,970.
General Electric Co., 1405 Locust St., Philadelphia 2, generators and regulators for use on various aircraft, $160,245.
Goodyear Tire & Rubber Co. Inc., 1144 East Market St., Akron, brake assy., 156 ea., $32,520; wheel assy., 385 ea., $82,593; maintenance parts used on brake wheel and cylinder assys., $106,023.
Grumman Aircraft Engr. Corp., Bethpage, L. I., N. Y., maintenance parts for various aircraft, $29,819.
Link Aviation Inc., Hillcrest, Binghamton, N. Y., maintenance parts, basic instrument trainer, $73,011.
McDonnell Aircraft Corp., St. Louis 3, parts for F2H aircraft, $345,067; spare parts for F2H aircraft, $216,399.
Pacific Paint & Varnish Co., 4th & Cedar Sts., Berkeley 10, Calif., deck paint, 28,500 gal., $46,805.
Scintilla Div., Bendix Aviation Corp., Sidney, N. Y., ignition parts for P&W 4360 engines, $67,828.
Shell Chemical Corp., 380 Madison Ave., New York 17, N. Y., acetone, $65,796.
Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y., electrical outlet box, 612 ea., $34,272.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J., maintenance parts used on ignition harness, $29,512.
Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn., material for use on HSD propellers, $93,610.
Westinghouse Electric Corp., Aviation Gas

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Turbine Div., Lester Branch Post Office, Philadelphia 13, material for use on J46-WE 8A/8B engines, $1,865,522.

Aerial Machine & Tool Corp., 38-27 30th St., Long Island City 1, N. Y., pilots safety belt, 6,450 ea., $26,445; webbing assy., 8,053 ea., $59,629.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, control assy., 74 ea., $29,900.

Atlas Paint & Varnish Co., 32-50 Buffington Ave., Irvington 11, N. J., exterior enamel, 18,000 gal., $30,495.

Capewell Mfg. Co., 50 Governor St., Hartford 2, Conn., D ring for parachute harness, 231,200 ea., $45,682.

Carolina Paint & Varnish Works, 1025 Howard St., Greensboro, N. C., enamel, synthetic, 11,460 gal., $27,946.

Champion Spark Plug Co., 900 Upton Ave., Toledo 1, plugs, $176,031.

Cleveland Pneumatic Tool Co., 3781 East 77th St., Cleveland 5, strut fork assy., 2 ea., $44,320.

USAF Contracts

Following is a list of recent USAF contracts announced by Air Materiel Command.

AiResearch Mfg. Co., 9851 Sepulveda Blvd., Los Angeles, actuator, data, 213 ea., $44,882.

American Machine & Foundry Co., Electronics Div., 1085 Commonwealth Ave., Boston, erection of shelters, 9 ea., $368,854.

Bell & Howell Co., 7100 McCormick Rd., Chicago 45, kit "A" and "B," 63 ea., 71 ea., $70,045.

Bendix Products Div., Bendix Aviation Corp., South Bend 20, Ind., wheel assy., 300 ea., brake assy., 3,600 ea., $1,176,966; brake assy., 972 ea., $404,023.

Consolidated Vultee Aircraft Corp., San Diego, Calif., TF-102A and F-102 aircraft, 20 ea., 37 ea., $74,942,059.

Fort Pitt Packaging Co., Inc., Mellon Stuart Bldg., Sandusky and Parkway, Pittsburgh, Pa., receive, process and store AF vehicles, $300,000.

Houston-Fearless Corp., 11801 West Olympic Blvd., Los Angeles 64, machine, automatic, film developing, 2 ea., $31,200.

Kollsman Instrument Co., Standard Coil Corp., 80-08 45th Ave., Elmhurst, N. Y., type M-5 true airspeed indicators, 459 ea., $142,428.

Lite Manufacturing Co., Inc., 101 W. 21st St., New York, line-head tow target, 17,374 ea., $116,535.

McDonnell Aircraft Corp., P. O. Box 516, Municipal Airport, St. Louis, RF-101A airplane spare parts, special tools, 28 ea., $34,025,262.

Royal Jet, Inc., 1024 Westminster Ave., Alhambra, Calif., 320-gal. jet-fuel tank for B-57 aircraft, 506 ea., $368,949.

Webster-Chicago Corp., 5610 Bloomingdale Ave., Chicago, maintenance spare parts, $87,310.

Westinghouse Electric Corp., 43 North Main St., Dayton, a. c. generators, regulators, control panels, S/P and data, $3,726,205.

Wright Aeronautical Div., Curtiss-Wright Corp., Wood-Ridge, N. J., maintenance tools for R3350-85 aircraft engines, bulk, $38,611.

AC Spark-Plug Division, General Motors Corp., Flint, Mich., spares for K-14 gunsight, $65,212.

Airtron, Inc., Linden, N. J., cable and lead assemblies, 922 ea., $172,032.

Allison Division, General Motors Corp., Indianapolis 6, Sundstrand speed drives, 437 ea., $5,154,750; increase in funds, $84,129; J33 engine, $199,000.

W. A. Apple Manufacturing, Inc., 213 Washington St., Dayton 2, Ohio, tow target, 21,488 ea., $366,370.

Arma Corp., Garden City, N. Y., factory for production of A3A fire control system, $127,500.

Atlas Film Corp., 1111 South Blvd., Oak Park, Ill., production of motion picture project, 1 ea., $37,160.

Beech Aircraft Corp., 6600 East Central Ave., Wichita, AF spare parts for D/A 1-23 airplanes, job, $293,356.

Bendix Products Division, Bendix Aviation Corp., South Bend 20, Ind., increase in funds, $76,949.

Bendix Pacific Division, Bendix Aviation Corp., 1600 Sherman Way, North Hollywood, Calif., radar set, 392 ea., $4,956,058.

Bendix Radio Division, Bendix Aviation Corp., Baltimore 4, radio compass, 461 ea., $557,116.

Bridgeport Brass Co., Bridgeport, Conn., facilities, $100,000.

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Rome Depot Awards

The following contracts were recently announced by the Rome AF Depot, Griffiss AFB, Rome, N. Y.:

• **Ansco Div., General Aniline & Film Corp.,** Binghamton, N. Y., plotting table, 17 ea., $44,153.

• **Bendix Radio Div., Bendix Aviation Corp.,** Baltimore 4, radar set, 20 ea., tower, 20 ea., maintenance spare parts, 20 ea., $6,376,506.

• **Craig Machine, Inc.,** 90 Holten St., Danvers, Mass., turntable, radar set, 5 ea., spare components, $108,000.

• **Empire Electronics Co., Inc.,** 166 River St., Paterson, N. J., cable assy., power, 142 ea., $28,187.

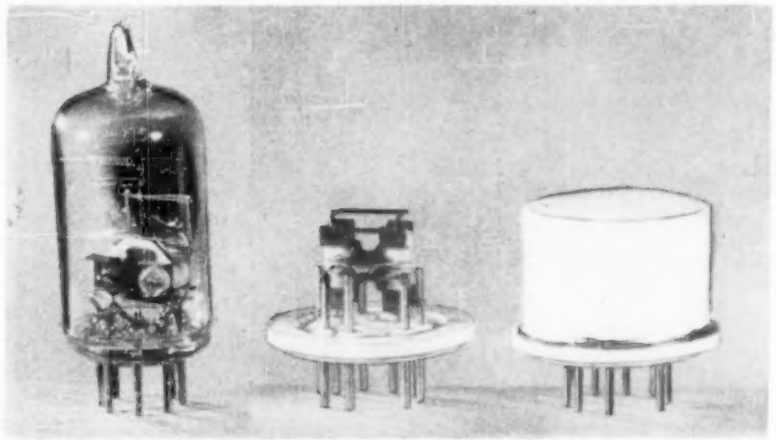
• **General Electric Co.,** 113 S. Salina St., Syracuse, N. Y., motor generator, 120 ea., $151,915.

• **Gilfillan Brothers, Inc.,** 1815 Venice Blvd., Los Angeles, cavity, tuned, 87 ea., mixer, 44 ea., $33,285.

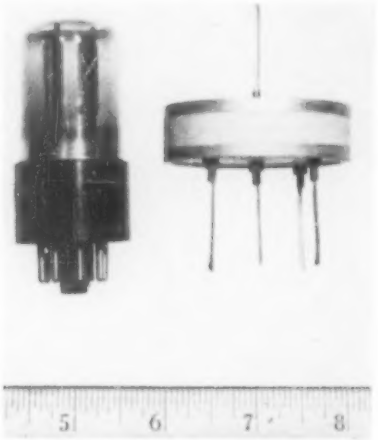
• **Hatfield Wire & Cable Div., Continental Copper & Steel Ind.,** 487 Hillside Ave., Hillside, N. J., lead, elect., 5,597 ea., $123,693.

• **Minnesota Mining & Mfg. Co.,** 900 Fauquier Ave., St. Paul 6, reflector, taxi strip, 50,000 ea., $87,500.

• **Multi Electric Mfg. Inc.,** 4223 W. Lake St., Chicago, light, 8,500 ea., $91,375.



SYLVANIA'S radical new tube construction, shown in glass and ceramic envelopes, is designed for mechanized assembly, longer life, higher-temperature operation.



EIMAC stacked-ceramic receiving tube bears little resemblance to conventional tube.

Stack Design Solves Big Tube Problems

By Philip Klass

Dayton—A new and radically different type of electron tube construction using stacked metal and ceramic elements has been developed which permits fully mechanized assembly, improves receiving tube uniformity, performance and reliability, and raises operating ambient temperature to 300-400C. The new type of tube was disclosed by two manufacturers in papers given before the recent airborne electronics conference here.

These all-ceramic tubes bear little resemblance, inside or out, to the conventional types which they may replace.

▶ **Sylvania & Eimac**—One of the tubes, developed by Sylvania Electric under Navy BuShips sponsorship, was described by Tom L. Evans in a paper co-authored by W. R. Wheeler. The recently declassified development was first revealed several weeks earlier by Sylvania's Robert N. Palmer at the Stanford Research Institute automation symposium in San Francisco.

The other new development, sponsored by Wright Air Development Center's Electronic Components Lab, was described by Harold E. Sorg, vice president of Eitel-McCullough, Inc. (Eimac), West Coast transmitting tube manufacturer.

The basic construction of receiving tubes has changed little since they were first built, using a type of construction borrowed from the lamp industry. Cantilever type electrode construction and glass bulbs, both carry-overs from lamps, have been a major source of tube trouble in aircraft and missiles. Even the new rugged premium type tubes are essentially just beefed-up versions of the older type construction.

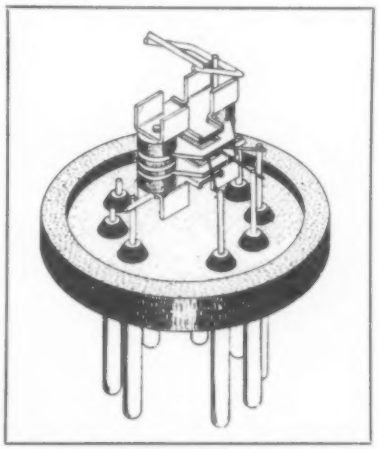
▶ **Something New**—Sylvania concluded that it would be difficult if not impossible to mechanize assembly of existing type tube construction. For instance, six or more electrode supports would have to be machine-inserted into tight-fitting holes in a thin, fragile mica spacer; then the supports would have to be aligned and fitted into the top mica spacer, an even tougher job.

Abandoning conventional sheath-type construction (one electrode surrounding another), Sylvania has turned to a layer-cake design. Flat tube elements are stacked on two supporting pins, separated and supported by ceramic spacers.

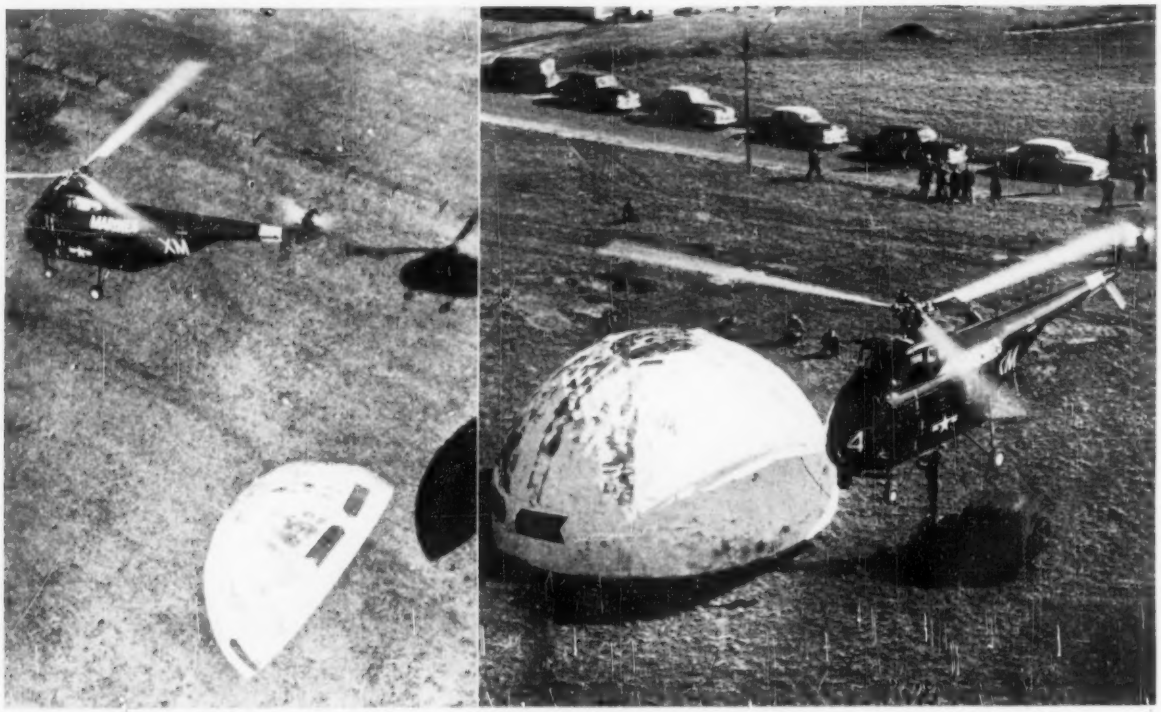
Sketch on p. 64 shows an exploded view of a twin-triode. By electrically connecting both plates and grids, the same unit can function as a single triode.

The resulting stacked tube can be housed in a glass bulb, or in a hermetically sealed ceramic container for higher-temperature operation.

▶ **No Mica**—By eliminating mica spacers, Sylvania has eliminated a major cause of tube failures. Stacked tubes, with their ceramic spacers, can be baked at much higher temperatures during manufacture to drive off contaminating



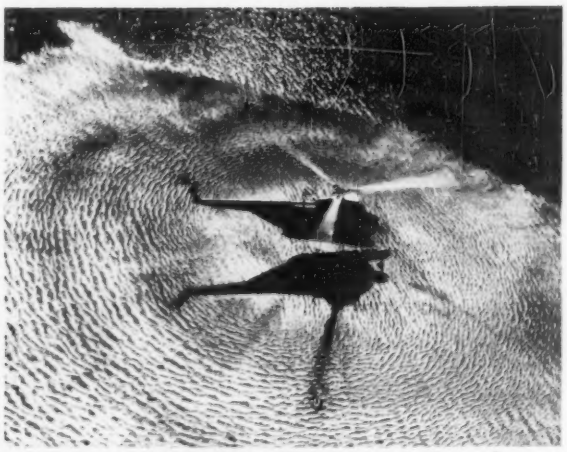
NEW Sylvania tube has low CG compared to conventional type (right), making it less susceptible to damage from shock and vibration. BuShips sponsored the development.



FLYING BARRACK—This igloo-like shelter, designed for Marine Corps use in the field, can be transported by air. The dome is 18 feet high, 36 feet in diameter, and can shelter up to 40 men. Even in a stiff wind, the 1000-pound plastic-covered hut can be moved easily from place to place by a Marine Corps HRS Sikorsky helicopter.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

WILDERNESS WINGS—A damaged light airplane was "rescued" from the frozen surface of Thunder Bay on Lake Superior by a chartered Sikorsky S-55 helicopter, and flown 25 miles to a repair base. Ambank Airlift, Limited, of Ft. William, Ontario, operates the new Canadian charter service, with S-55 equipment exclusively.



PRACTICE MAKES PERFECT—This unusual photo shows a Sikorsky H-19 helicopter over the Han River near Seoul in a simulated rescue of a downed pilot. The practice mission by a U.S.A.F. Air Rescue crew was similar to nearly one thousand actual rescues during the Korean war, made on land and at sea behind enemy lines.

HELICOPTER EXPRESS — Regularly scheduled Air Express flights in Southern California form a new service started last December by Los Angeles Airways, Inc., and the Air Express division of Railway Express Agency, Inc. Big Sikorsky S-55s, like that above, and S-51s, are used for the speedy shuttle to cities as far inland as San Bernardino.

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gases which cut tube life. The new tubes can be operated at 300-400C without danger of mica-released moisture attacking the cathode and reducing tube life.

Mica spacers used in conventional tubes are easily deformed and broken, are weakened by the hole punching operations. Ceramic spacers are more rugged, are not subjected to punching operations.

Any looseness of fit between electrode supports and mica holes in conventional tubes operated under conditions of vibration or shock tends to enlarge the mica holes, produce tube microphonism. In the stacked tube, ceramic spacers are not subjected to deteriorating forces under vibration.

► **Other Advantages**—Sylvania engineers cite other operational advantages for the new stacked construction:

• **More rugged.** The Sylvania technique produces a rigid assembly with a low center of gravity, making tube less affected by vibration and shock. Evans reported that microphonic noise of a stacked tube under vibration is much lower than in conventional tube types. If the stacked tube is mounted in a sealed ceramic housing, instead of a glass bulb, it can be dropped and shipped without damage, Palmer reported.

• **Resists thermal shock.** The ceramic-housed stacked tube has been removed from liquid nitrogen at a temperature of −195C and plunged into boiling water (100C) without fracture. It has also been cycled more than 100 times from room temperature to 450C without damage, Palmer reported.

• **Longer life.** Ceramic stacked tubes have been operated at 300C for 2,000 hours with less than a 15% drop-off in their transconductance. Tubes now under life test at 400C have been operated for 1,000 hours and are still satisfactory, Palmer reported. Except for recently announced tubes with hard-glass envelopes, most conventional tubes are limited to 175C.

► **Manufacturing Advantages**—From the standpoint of a tube manufacturer, the new technique has several attractive advantages:

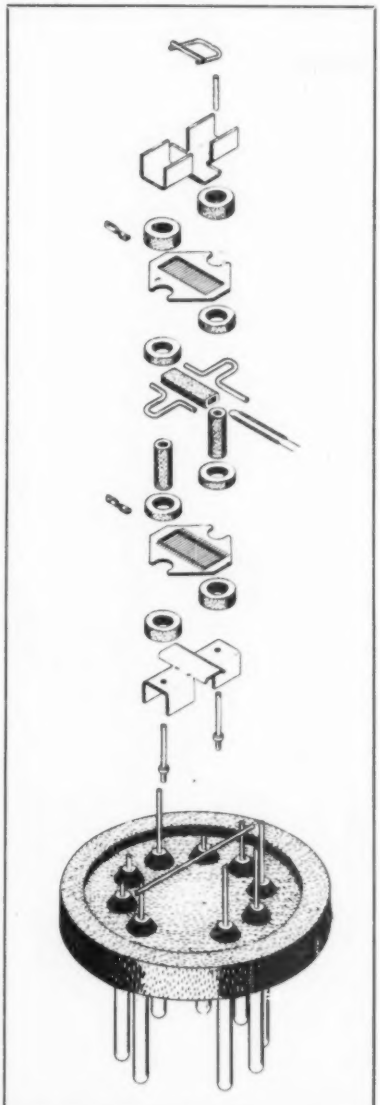
• **Fewer critical dimensions.** The thickness of the ceramic spacers, which determines interelectrode spacing, is the only critical dimension. This can be held to 0.0005 inch, Evans says. In conventional tube construction, there are a variety of critical dimensions, including location and diameter of mica spacer holes. These cannot be held closer than 0.001 in., Palmer reported.

• **More rugged elements.** Individual elements of the tube are more rugged, less easily damaged in manufacture and assembly, Sylvania engineers say.

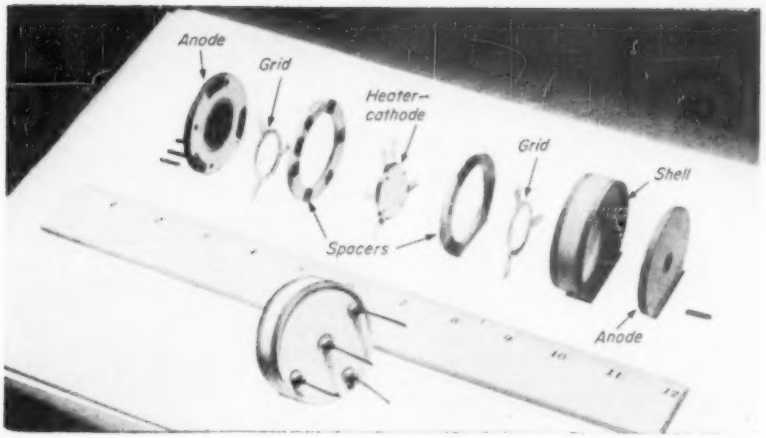
• **Greater uniformity.** An example of the improved tube uniformity resulting from the Sylvania technique is a comparison of the spread of mutual conductance (G_m) for a group of stacked and conventional tubes. (Measurements were made before testing and culling which normally weeds out tubes outside tolerances.) Mutual conductance of conventional tubes varied between 800 and 2,000 micromhos; G_m spread for the stacked tube was only 1,500 to 1,800 micromhos.

► **Life Test Comparison**—Sylvania conducted life tests on a stacked triode, type SN-1724D, in a glass envelope and on a conventional premium tube type 5718 at room temperature. After 2,000 hours, the stacked tube G_m had dropped only 5%, compared to a 13% drop for the conventional tube.

When both were life tested at a 175C



SYLVANIA tube, in exploded view, shows unusual configuration of elements and illustrates why tube can be machine-assembled.



EIMAC experimental twin-triode stacked-ceramic tube has some similarities, some differences, compared with Sylvania stacked tubes. WADC sponsored Eimac's work.

temperature, the stacked tube's G_m dropped less than 15% during the first 1,200 hours, compared to 33% for the type 5718; then the stacked tube's G_m fell off sharply to reach a value comparable to the 5718 at the end of 2,000 hours. Sylvania attributes this sharp fall-off to electrolysis of the glass envelope, not to internal tube shortcomings.

Life tests of a ceramic envelope stacked tube (SN-1724D,) showed a G_m drop-off of about 10% after 2,000 hours at room temperature, slightly higher than the same tube in a glass envelope. Sylvania attributes this to difficulties in processing ceramic envelopes with which industry has little experience. The same tube operated at 300C ended up with a G_m drop-off of about 10% at the end of 2,000 hours, although it fell to 17% midway in the tests.

► **Disadvantages**—Interelectrode capacitance of the new stacked design is slightly higher than for conventional construction, Evans admitted, but some reduction has been achieved and more is expected.

Sylvania's work to date has not included an economic analysis of the cost of mass-producing the new tubes. Evans believes that labor savings may offset the slightly higher material costs of the new type of construction.

► **Weight Comparison**—In a glass envelope, the new Sylvania SN-1724 weighs 5.5 grams, slightly less than its conventional 6J6 counterpart at 7.3 grams. In a ceramic envelope, the new tube weighs 13.6 g., about twice as much as a 6J6. However, if Sylvania ceramic tubes were substituted for conventional ones in an interceptor which used 600 tubes, overall equipment weight increase would be only 9 lb. This is a small price to pay for improved reliability and long life.

If ceramic manufacturers can develop stronger materials, which Evans thinks they will, the thickness of the ceramic container walls and its weight can be reduced.

Sylvania has proposed to Navy's BuShips the further development of its stacked tubes to include tetrodes and pentodes. The next step would be the design of machinery to assemble the stacked tubes automatically.

► **Eimac's Approach**—Eitel-McCullough, which has been building ceramic transmitting tubes, is exploring ceramic construction of receiving tubes under USAF sponsorship. Eimac's Harold Sorg reported. Objective is mechanized production, improved reliability, higher-temperature operation.

Eimac has designed an all-ceramic twin-triode whose performance is comparable to a conventional 6SN7. Interesting external feature of this tube (p 61), aside from its unusual pill-box configuration, is the use of flexible leads instead of the familiar plug-in base. Eimac expects the tube to be so reliable that it can be soldered into a circuit like a resistor or capacitor.

► **Stacked Construction**—The Eimac tube also uses a stacked construction for ease of mechanized assembly. In the experimental twin triode, the two anodes are contained in the ceramic end disks (see exploded view, above). Grids are formed on a ceramic frame by a photographic electroforming process. The cathode button and heater element are manufactured as a single unit for structural rigidity. Ceramic spacers support and separate the tube elements which are brazed solidly in position.

The stacked construction of Eimac, like that of Sylvania, is adaptable to a variety of tube types. By eliminating the grids, one has a twin diode. By inserting more grids, the tube can be made into a twin tetrode. Similar building-block construction is possible for either single or dual-function tubes.

► **Better Evacuation**—Elimination of mica and glass permits the new tube to be baked and evacuated at high tem-

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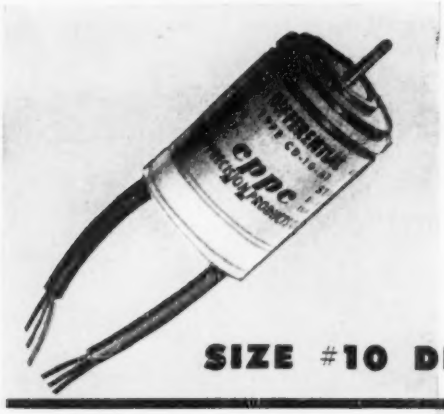

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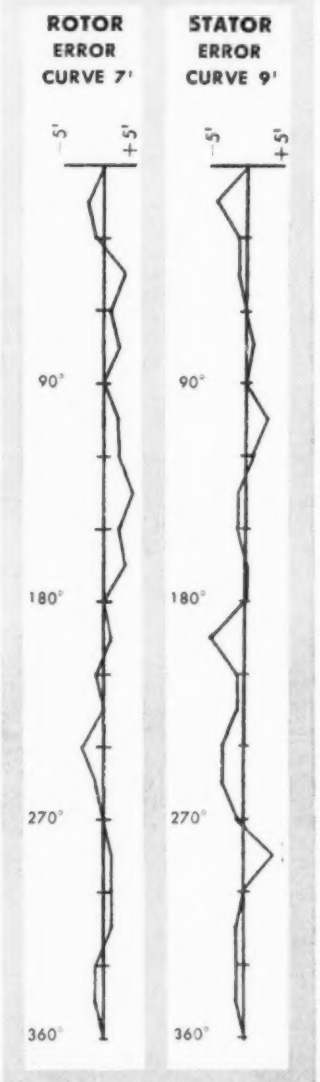

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peratures (650C or higher) to get rid of contaminating gases. This eliminates the need for flash-type getters used in conventional tubes to remove contaminating gases but which themselves may introduce impurities into the tube envelope atmosphere.

Eimac plans to produce the new type tube on a pilot line basis to evaluate its design, but Sorg emphasized that the design is an exploratory one and subject to change. "Although much remains to be done in our work and no quick results can be expected in a long-range program of this kind, nevertheless we feel that we are making headway toward the production of more reliable tubes," Sorg said.

"With the improved ceramic tubes, there certainly will be fewer failures of the catastrophic kind in the mechanical category. There is also good reason to believe that failures in the electrical category will be alleviated," Sorg concluded.

▶ **Engineers Can Hope**—Industry engineers who are trying to make "old fashioned" tubes perform reliably in the high-temperature, high-altitude, high-shock environment found in guided missiles have expressed the hope that Navy and USAF will put all possible steam behind the Sylvania and Eimac programs to bring them out of the laboratory and into production.

New Avionic Products

A new line of sub-miniature non-linear ceramic capacitors whose capacitance can be varied as much as 60% by a change in the applied d.c. potential, is one of several recently announced components suitable for avionic equipment.

The new non-linear capacitors, which are also temperature sensitive, come in two types: VSR, whose voltage sensitivity is a maximum at room temperature; VSE whose sensitivity is maximum at 70C. Capacitance values of 300 mmf. and larger are available. Mucon Corp., 9 St. Francis St., Newark 5, N.J.

Other new components include:

- **Sub-min snap-action switch.** Type USM, ⅝x⅜x½ in., comes in plain or

leaf actuator styles, SPDT, rated at 5 amp. 125/250 v. a.c., or 2 amp. at 30 v. d.c. Unimax Switch Div., W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y.

• **Miniature photo-transistor,** p-n-p junction Type RR66, is hermetically sealed in glass bulb only $\frac{3}{8}$ in. dia., $\frac{3}{8}$ in. high. A sub-miniature version, only $\frac{1}{4}$ in. dia. x $\frac{3}{8}$ in. will soon be announced. Technical details and recommended circuits can be obtained from Radio Receptor Co., Scletron & Germanium Div., 251 W. 19th St., New York 11.

• **Miniature blower,** reportedly able to supply 24 cubic feet per minute under continuous duty, is powered by a permanent magnet d.c. motor rated at 6 to 115 v., $\frac{1}{2}$ amp. Unit measures $2\frac{1}{4}$x$2\frac{1}{4}$x4 in. Pioneer Electric & Researchr Corp., 743 Circle Ave., Forest Park, Ill.

• **Tube socket for printed circuit** boards, made of Mycalex 410 glass-bonded mica, has loss factor of 0.014 at 1 mc., power factor of 0.0015 at same frequency, according to manufacturer, Mycalex Tube Socket Corp., Clifton Blvd., Clifton, N. J.

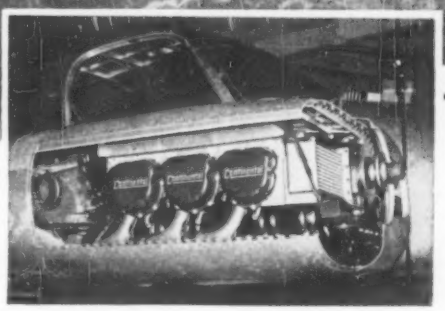
• **Low-loss casting resin** of the thermosetting type, has a dielectric constant of 2.36 to 2.38 over frequency range of 60 cycles to 10 kmc., dissipation factor under 0.0009, dielectric strength of 450 v./mil, and volume resistivity above 10^{18} ohm-cm.^{3}, according to manufacturer. Tensile strength is quoted at 5,000 psi., Rockwell (M-scale) hardness at 50, temperature range at −70C to 125C. Manufacturer is Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

• **D.C. motor,** Type SS, measuring $\frac{7}{8}$ in. dia, $1\frac{3}{8}$ in. long, is permanent magnet motor, operating from 27-v. d.c., with stall torque of 1 in. oz. and no-load speed of 14,000 rpm. Device has double-sealed life-lubricated bearings, weighs 2 oz. Manufacturer is Globe Industries, Inc., P.O. Box 101, North Dayton Station, Dayton, Ohio.

ILS-VOR Indicators

New ILS and VOR indicator, model ARC-16706, combines cross-pointer meter and omnirange course selector in a single $3\frac{1}{4}$ in. instrument, weighing 3.3 lb. Manufacturer is Aircraft Radio Corp., Boonton, N. J.

Compact Power for Modern Planes



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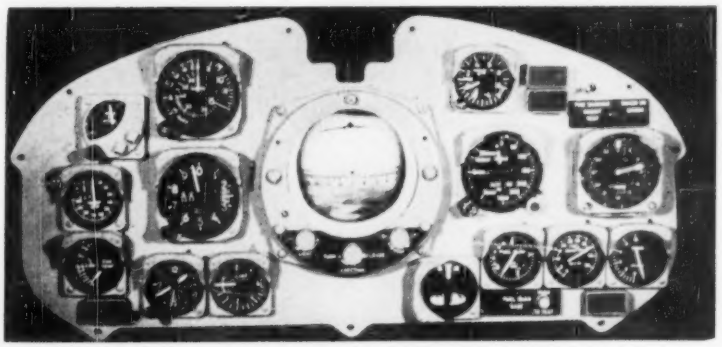


NEW F9F-6 PANEL gives more information than conventional type, says Navy.

Navy Tests Simplified Panel

Navy's new simplified instrument panel for jet fighters, now under evaluation in an F9F-6, is centered around a new combined heading-attitude indicator designed to give the pilot a feeling of contact flight during instrument flight conditions.

Navy says the new panel provides more information than the conventional one. It is the first step in BuAer's program to reduce the 18 months and nearly $50,000 required at present to train all-weather jet fighter pilots. Navy test pilots who have tried the new panel are "unanimously enthusiastic," a BuAer spokesman says.

Lower half of the combined indicator is a ground landscape and heading indicator which rotates, presenting a changing panorama, as the airplane itself turns. This gives the pilot what human engineers call "mass motion" similar to what he sees under contact conditions. Miniature plane on the instrument climbs, dives, and banks relative to sky and landscape to indicate actual airplane attitude.

The new indicator is servo-driven from signals provided by a remote directional and a remote vertical gyro. Next step in indicator development will include provision for displaying ILS-type instructions and deviation from desired altitude.

Other interesting features:

• **Smaller instruments.** Rate-of-climb and turn-and-slip indicators are relegated to secondary positions just below the heading-attitude indicator and reduced from 3¼ to 2 in. dia.

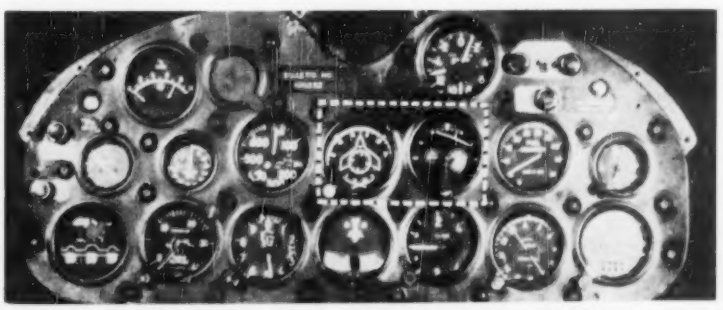
• **Digital altimeter.** Counter is used to indicate barometric altitude in thousands of feet; pointer is retained for hundreds-of-feet indication.

• **Dead-reckoning "VOR-DME."** New type of highly accurate self-contained navigation system which provides VOR-type bearing and DME-type distance information presents both to pilot on a single instrument (above, center, extreme right).

• **Mach & airspeed.** Single combination instrument gives pilot his airspeed and Mach number.

Navy believes it has finally solved the instrument panel lighting problem by building needed lighting into individual instrument case. (The heading-attitude and angle-of-attack indicators in top photo have integral lighting.)

BuAer is continuing its program to develop improved and simplified panels.



OLD PANEL has separate heading and attitude indicators (in dotted lines).

FILTER CENTER

▶**Missile Thermal Barrier**—Cooling of avionic equipment in guided missiles is a major problem at high speeds and altitudes, as many designers are learning. For example, at 30,000 ft., ram air temperature is 350F at Mach 2, 790F at Mach 3, and 1,420F at Mach 4, K. D. Wuerl of the Wright Air Development Center told the recent Dayton airborne electronics conference. At higher altitudes, temperatures are slightly lower, but cooling efficiency of air at 100,000 feet may be only 1% of air at sea level, Wuerl pointed out. Associated problem is one of rapid temperature change. A missile's skin temperature can zoom from —40 to 250F within seconds after launching.

▶**Hot Chopper**—A new hermetically sealed chopper (vibrator) reportedly capable of operating in an ambient temperature of —70C to 200C, has been announced by Airpax Products Co. New Model A-100 is a 400-cycle, 6.4-v. break-before-make chopper having a nominal phase angle of 65 deg. and a dwell time of 135 deg., company reports. Address is Airpax Products Co., Middle River, Baltimore 20, Md.

▶**Transistor Life Tests**—Nine months of life tests on Minneapolis-Honeywell's new power transistors, operated at 7 watts dissipation, have produced no failures to date, MH's V. W. Bearinger told the recent Dayton airborne electronics conference.

▶**UAL DC-7 Relies On Autopilot**—Sperry Gyro reports that its A-12 autopilot was in use 90% of the time during United Air Lines recent inaugural DC-7 flight between New York and Hawaii. —PK

Avionic Bulletins

Recently announced technical bulletins and catalogs of interest to the avionics field include:

• **High-frequency resistors,** application data, Bulletin F-3, International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

• **The Synchro Story,** 20-page brochure describes materials, processes and operations involved in manufacture of precision synchros. Clifton Precision Products Co., Inc., Marple at Broadway, Clifton Heights, Pa.

• **Avionic components,** including sub-min resistors, precision and power resistors, deflection and focus coils, and RF and IF transformers are described in 36-page booklet. I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

• **Germanium diode and transistor** catalog, Bulletin No. G-23, lists 32 types of diodes, including four JAN types, and nine hermetically sealed p-n-p diffused junction transistors, 8 pp. Seletron and Germanium Div., Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.

• **Automation techniques,** a system of re-

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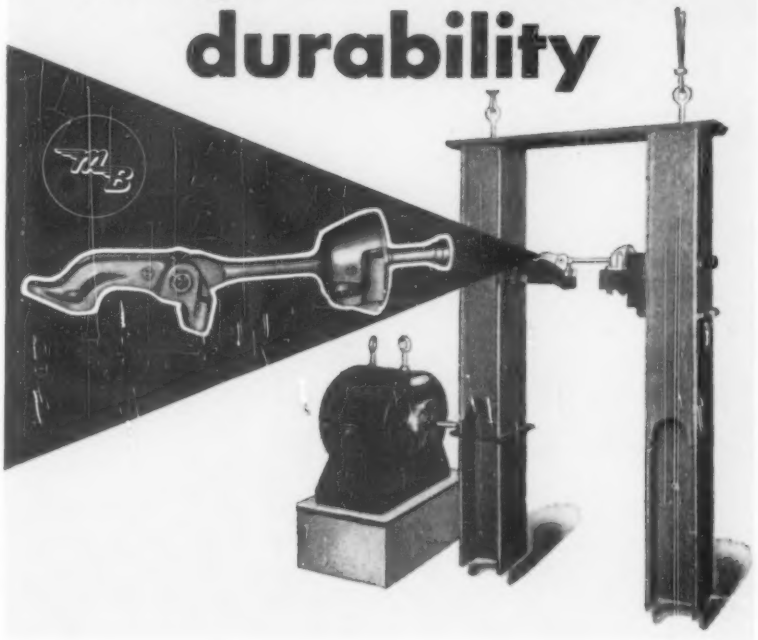

The photograph shows how MB vibration isolating mounts were put to a grueling fatigue-strength test . . to check the complete dependability of these vital engine supports.

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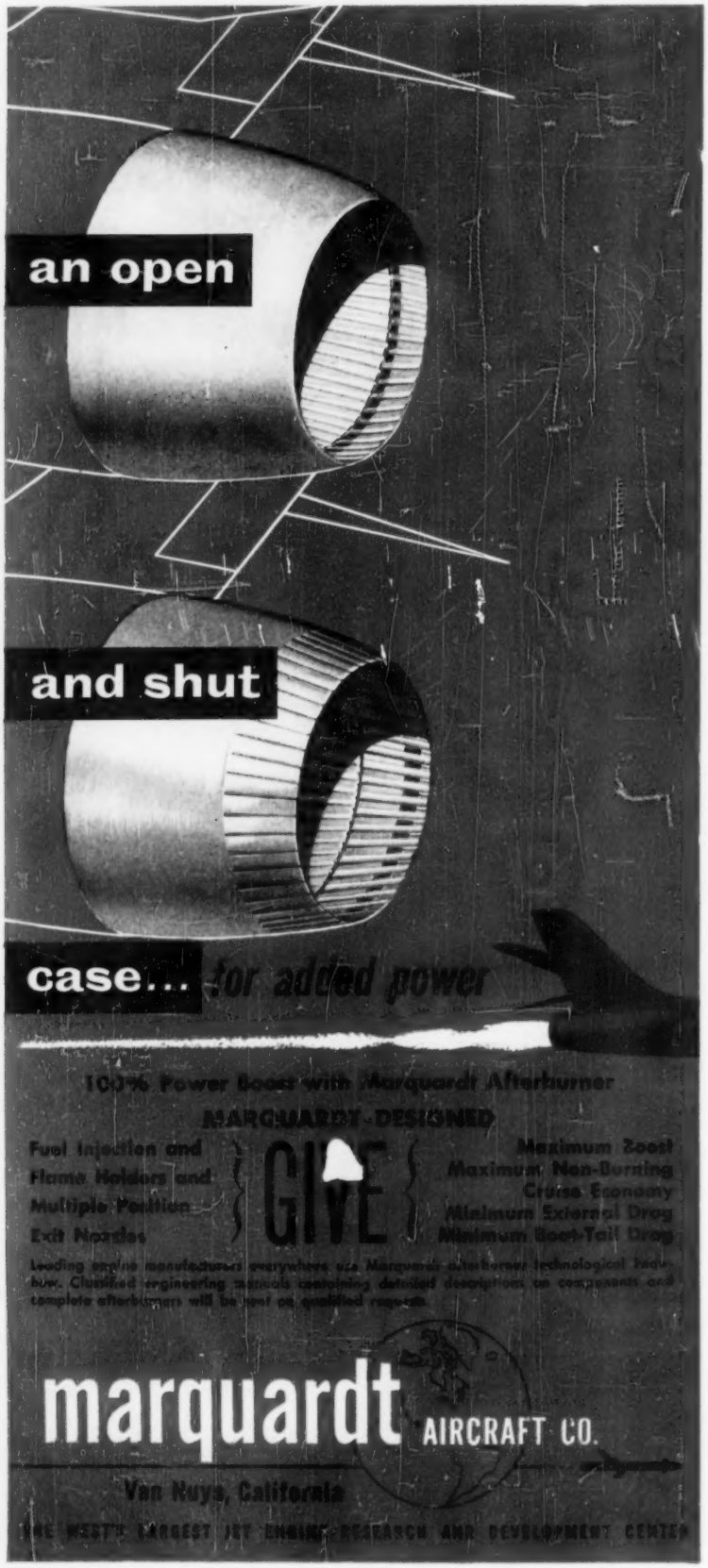


cording motion on magnetic tape and playing it back for automatic programming of production machines and processes. Bulletin GEA-6092, 6 pp. General Electric Co., Schenectady 5, N. Y.

• **Servomechanisms components,** computers (air data, Mach number, sweep servo) and company facilities, 12 pp. Servomechanisms, Inc., Westbury Div., Post & Stewart Ave., Westbury, N. Y., or El Segundo Div., 316 Washington St., El Segundo, Calif.

• **Copper-clad laminated plastic,** new grade FF-91, first introduced at recent IRE convention, described in basic information folder. Formica Co., 4614 Spring Grove Ave., Cincinnati 32, Ohio.

COMPONENTS of GE's high-accuracy gyro compass system for polar navigation.

Light Gyro Compass System Has Low Drift

A new 20-lb. high-accuracy gyro compass system, with a reported drift rate of only 4 deg./hr. when operated without magnetic slaving, has been announced by General Electric's Meter and Instrument department. The lightweight MA-1 can be operated as a conventional slaved gyro at lower latitudes, or as a "free" gyro when used in the polar regions.

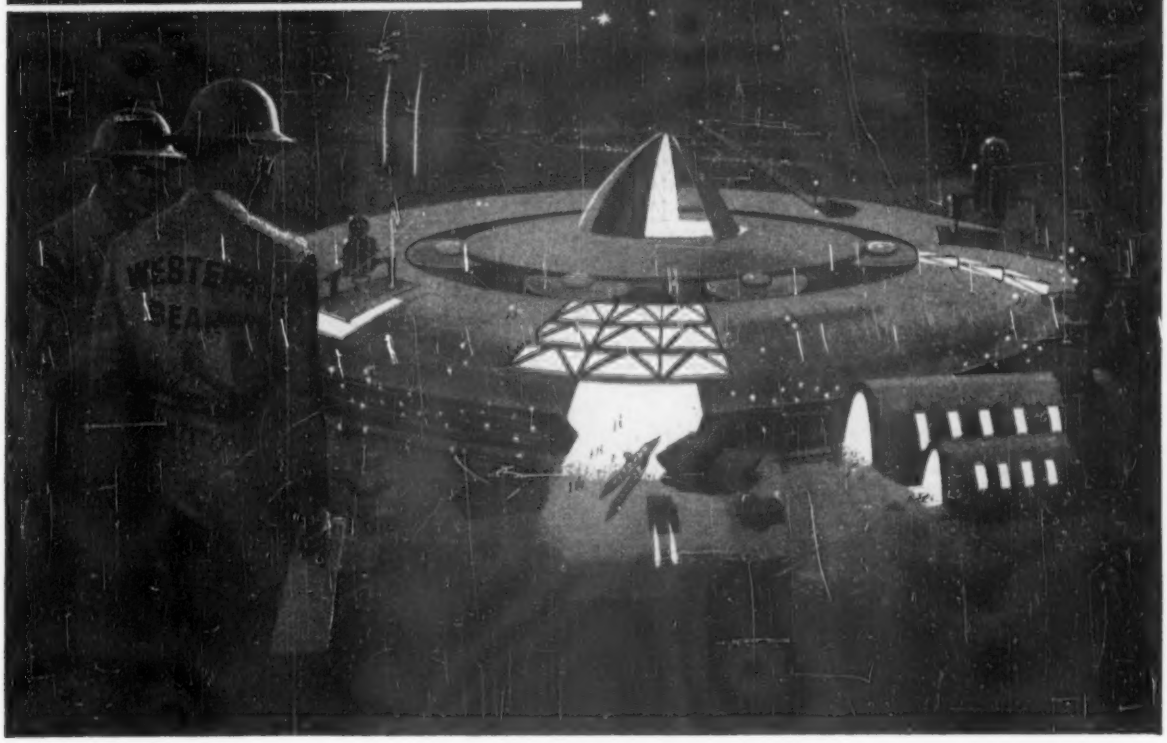
The GE compass system provides two separate output signals from dual servo-driven synchros. One signal may be used for autopilot, the other for a panel indicator of the heading or radio-magnetic indicator (RMI) type.

The system consists of four components: a remote compass transmitter, hermetically sealed directional gyro, amplifier, and pilot's controller. The company says system will operate from any compass transmitter built to USAF Spec AF-27635.

When operated as a free gyro in the polar regions, pilot sets in approximate airplane latitude on his controller to compensate for earth's rotation which would otherwise cause apparent gyro drift. Normal slaving rate is 2 deg./min.

Bulletin GEA-5998, describing the new MA-1, may be obtained from the manufacturer, General Electric, Schenectady 5, N. Y.

GEAR DRIVES for SPACE STATION



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Perhaps not; but when interplanetary travel becomes possible you can bet that Western Gear Works' research, engineering and manufacturing skills will have contributed mightily to such progress. Our company has paced the growth of flight from its early days, designing and building mechanical and electrical power transmission drives for the multitude of needs of equipment operation and aircraft control. We believe we have designed and manufactured more actuators and accessory drives than any similar company, for there is scarcely an aircraft today that does not have one or more Western Gear products aboard.

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1. BREAKS SUPERSONIC SPEED RECORD. On December 12, 1953 the rocket-powered Bell X-1A traveled 2½ times the speed of sound — or more than 1600 miles an hour. This record-breaking plane relies on Fenwal's newest Over-Heat Detectors to give instant warning of overheat conditions.

2. WORLD'S LARGEST TRANSPORT HELICOPTER is this twin-engine, tandem-rotor Piasecki H-16, recently unveiled by the U. S. Air Force. It carries 49 troops, 32 litter patients or three jeeps. The H-16 depends on Fenwal Midget THERMOSWITCH units to warn of overheating in transmission gear boxes, and THERMOSWITCH heater controls for cabin combustion heaters.

3. FENWAL FIELD ENGINEERS work directly with airframe, aircraft engine manufacturers, armed services and civilian airlines on the proper application of our products. Here, two Fenwal engineers confer with an Eastern Air Lines technician on special test equipment.

4. AMONG THE LATEST FENWAL DEVICES are those pictured here — used in the newest research, Air Force, and civilian airline planes. The shell is the fast-acting temperature-sensitive element in all Fenwal units. They include Fire Detectors, Regular and Midget Over-Heat Detectors and cabin Heater Controls, to meet all aircraft temperature control and detection requirements. For complete data write **Fenwal Incorporated, 126 Pleasant St., Ashland, Mass.**

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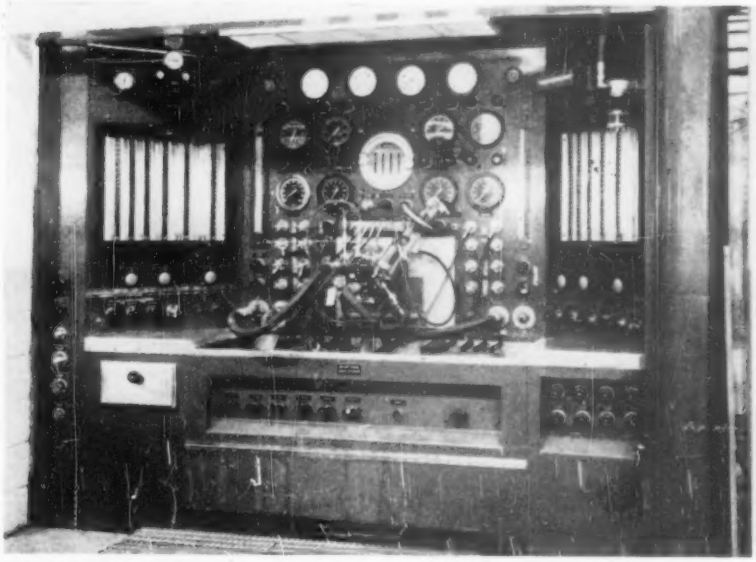


TEST STAND used by Bendix to check operation of jet engine fuel control.

Stand Gives Fast, Accurate Checks

Equipment for testing Bendix jet fuel control units is correct to .5% at flows of 85-30,000 lb./hr.

A new test stand, with highly accurate instrumentation, gets laboratory precision at production-line speeds on jet engine fuel control units built by Bendix Products, according to Berkeley division, Beckman Instruments, Inc., maker of some of the stand's components.

Examples of the accuracies required of the stand are:

- **Rate of fuel flow**—0.5% through a flow range of 85 to 30,000 lb. per hr.
- **Revolutions per minute**—engine speed must be determined to an accuracy of ± 1 rpm. over a 25:1 range.

A Berkeley official says "Such accuracies formerly were attainable only through elaborate laboratory-type instruments, requiring skilled technicians and slow, costly laboratory techniques. These obviously were unsuited to the production conditions faced at Bendix. As a result, the special instrumentation and test stand . . . was developed. . . . A large number of stands are now in use."

▶ **Test Stand—General**—The test stand is conventional in appearance—it contains flowmeters, atmospheric and fluid pressure gages, etc., associated controls and a liquid sump under the unit to be tested.

Among the components going into making up the unit are: fuel tank, boost and pressure pumps, heat exchanger, multi-stage filters (to 5 micron), input and output fuel rate meters, electronic tachometer, altitude simulator, metering valves, manual throttle and miscellaneous pressure measuring meters.

Elaborate precautions have been taken to avoid the possibility of mishap due to the explosive characteristics of the fuel being handled.

Precautions have been taken to prevent sparks or flames in the fuel area. All electrical equipment is designed to meet Class 1, Group D specifications. Blow-out disks and heavy safety glass covers protect the flowmeter tubes. Instruments are mounted on a thick aluminum panel with connections at the back of the panel wherever possible. And facilities are provided for draining any fuel spilled when changing components and returning the fluid to the supply tank.

▶ **Flowmeter**—The flowmeter, manufactured by Commercial Research Laboratories, Inc., has a minimum and maximum capacity of 85 to 30,000 lb./hr. with an accuracy exceeding ± ½%.

The multiple-stage, Type 12 unit is made up of six Pyrex glass metering tubes with integral float guides. A moving float in each glass indicates, by its position in the glass, the rate of flow. If flow rate exceeds the full range of a given tube, float goes to the top of the tube and flow is read on the adjacent tube. Readings are taken from a logarithmic scale.

A rigid calibration check schedule is maintained on the flowmeter, with a complete recalibration being made yearly on precision weighing equipment.

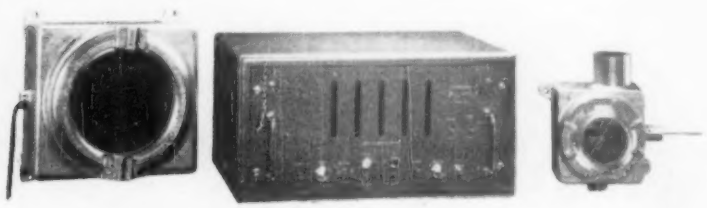
In case of calibration shift, new scales are engraved on the flowmeter.

▶ **Tachometer**—Bendix did a lot of original research to develop a tachometer accurate enough for the test stand.

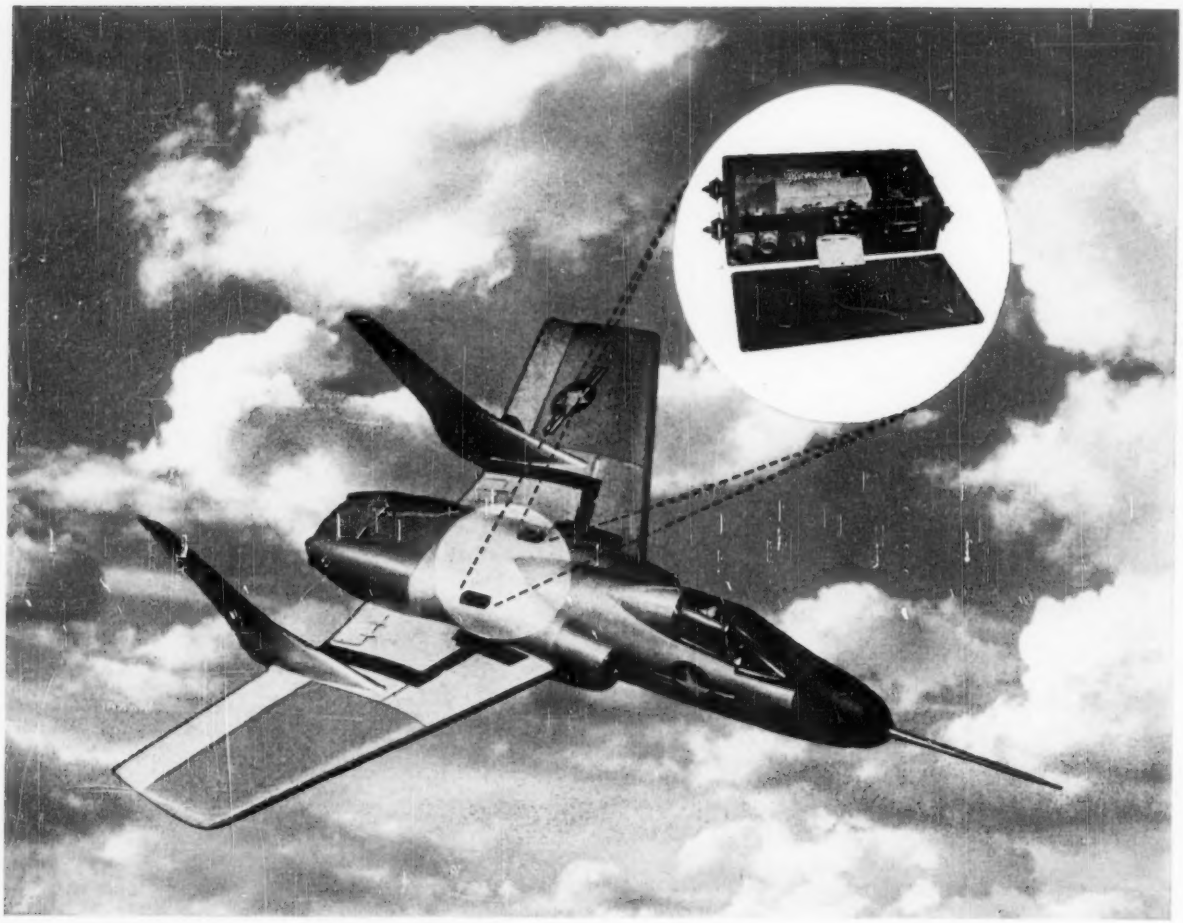
Only the electronic digital tachometer seemed capable of giving the accuracy required of ± 1 rpm. plus quick, easy reading of the indications. The tach does not have the reading complexity of the otherwise highly accurate stroboscopic-type tachometers, nor the parallax reading errors normally associated with meter tachometer representations. And the electronic tachometer can be calibrated quickly and inexpensively, resulting in a minimum of "down time."

The electronic tachometer is made up of three units: the variable reluctance pick-up, the time base and gating unit and the four-digit, remote indicator. The pick-ups is a Berkeley instrument mounted in a Crouse-Hinds housing. The time base and gating chassis is also made by Berkeley.

This is how Berkeley describes the operation of the electronic tachometer: "The tachometer pick-up is composed of a magnetic sensing element, a 120-toothed gear and a shaft on which the gear is mounted. The sensing element is a permanent magnet surrounded by a coil. Each time one of the teeth of the gear passes under the head of the permanent magnet, the reluctance varies



ELECTRONIC TACHOMETER parts (l. to r.): remote indicator, EPUT meter, pickup.



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You want and must have completely reliable temperature control amplifiers — amplifiers designed and constructed to meet specific basic requirements of your turbojet engines, such as:

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3. Operation in altitudes up to 60,000 feet through the use of hermetically-sealed components.
4. Center-of-gravity shock mounting to permit installation right on the turbojet engine.

Manning, Maxwell & Moore turbojet engine temperature control amplifiers satisfy all four requirements. They incorporate a highly successful design principle thoroughly proved during years of concentrated research, development and tests devoted exclusively to automatic control systems for jet engines.

We believe our ability to apply our unique design technique to specific and unusual turbojet engine temperature control problems can be of real value to you. Our engineering counsel and extensive manufacturing and test facilities are at your service. We welcome your inquiry.

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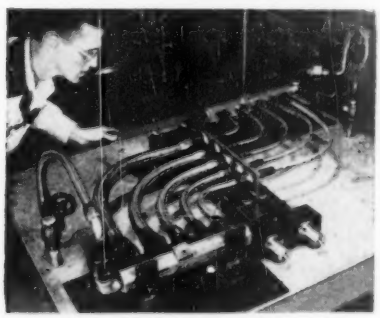
and a voltage is induced in the coil. Since the sensing element is a low impedance source, it is possible to cable this output over a considerable distance to the remote EPUT (Events-per-Unit-Time) meter.

"The EPUT meter consists of a two-cycle-per-second, crystal-controlled time base, an input amplifier driving an electronic gate, and the gating section. The time base activates the gating circuits which in turn opens the electronic gate for a 0.5 second. The tachometer pulses received during this precise 0.5-second period are passed in attenuated form to the cascaded decimal counting units in the remote indicator. At the end of the counting period, the gating section begins timing the length of the display of the digital reading on the decimal counting units. This display can be adjusted from 0.5 seconds to infinity. At the end of the display time, the reading is erased and the system is ready to make a new reading.

"The four-digit indicator is composed of four decimal counting units and an input amplifier circuit. Power for this unit is obtained from the basic EPUT meter. The input circuit is used to bring the attenuated signals from the EPUT meter up to a level suitable for driving the first of the cascaded decade units. The number of pulses passed by the electronic gate are then totalized on the decimal counting units. This result is indicated in decimal form on the numbered Lucite panels of each decade. Since 120 teeth are used on the gear and the counting interval is 0.5 seconds, or 1/120th of a minute, the digital indication is directly in rpm. The system can be set so that a reading is made once every second."

► **Other**—The stand is also equipped with a vacuum pump for altitude simulation and various pressure meters which give the operator a clear indica-



Ten-in-One Vibrator

Aeroquip Corp. uses this synthetic hot oil circulation test stand to vibrate simultaneously all 10 sizes of engine and aircraft hose made by the company. The stand, installed at the firm's Jackson, Mich., plant, vibrates lines at ¼ in. amplitude and 1,750-cps. frequency.

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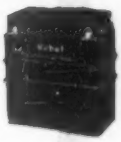

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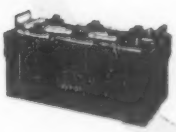

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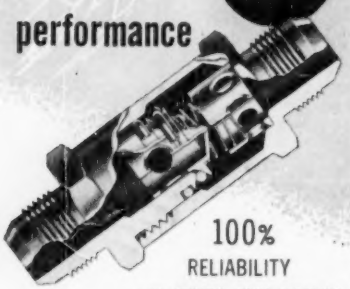

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tion of the functioning of the fuel control system.

The stand gives results in the form of a curve showing rpm. versus rate of fuel flow from idle to full throttle. These data are compared with a given standard and adjustment made if required.

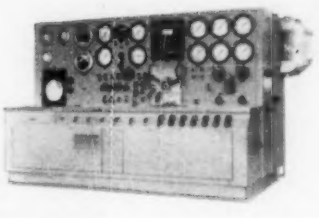
The fuel control unit is designed to hold the governed speed with a high degree of accuracy.

Test Stand Checks J73 Fuel Regulator

A new Greer Hydraulics test stand checks the performance of PE3A fuel regulators for General Electric's J73 turbojet engines.

The stand simulates all operating conditions of the fuel regulator, including mechanical, hydraulic, pneumatic, thermal and electrical, and checks the unit's response, allowing comparison with specifications, says the Brooklyn, N. Y., manufacturer. Basic speed for the stand were set up by GE.

The test equipment is made up of six separate components: main cabinet, which houses the major units of the stand's seven systems; flowmeter panel mounting three fuel-in flowmeters with ranges from 126 to 18,000 pph.; three discharge line flowmeters in the same range, including low-flow by-pass valves; electrical control cabinet; GE Thymotrol transformer and control cabinet; and an electronic counter control unit



TEST STAND built by Greer for GE.

with an accuracy of ± 1 rpm.

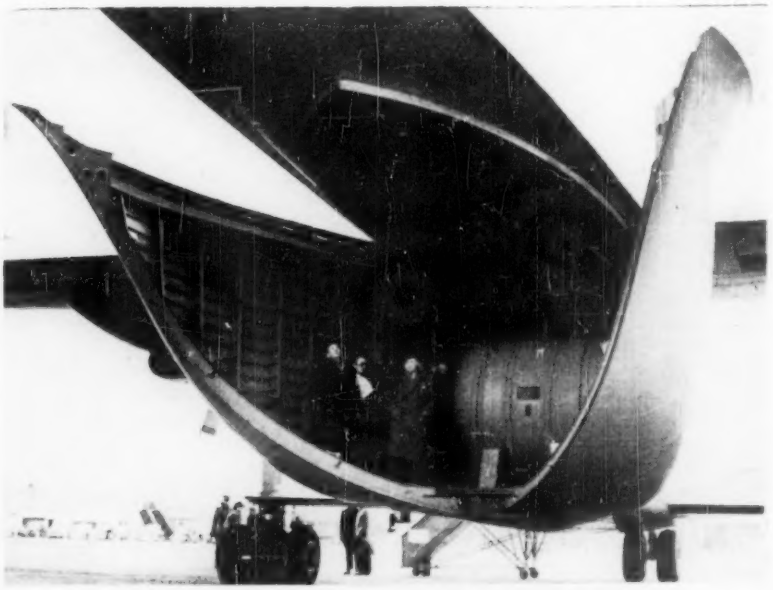
The stand is powered by a 7½-hp. drive with a speed range of 75 to 4,000 rpm. and with accelerations from 0 to 1,000 rpm. in five seconds (based on inertia of 0.15 in./lb./sec.).

Vickers Streamlines Supercharger Motor

Redesign of Vickers, Inc.'s aircraft-type hydraulic motor has eliminated eight connections and two lengths of hose in the Douglas DC-7 supercharger hydraulic circuit, where the motor is used.

Known as Model MS70-3915, the unit features a special head, or valve plate, with integral relief valve; a temperature bulb port; two special ports for circuit replenishing, and the standard inlet and outlet ports.

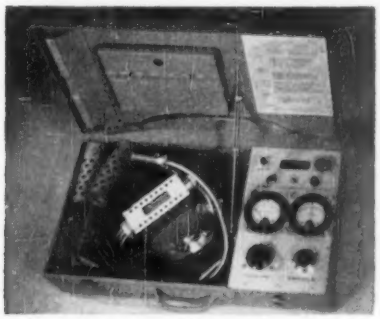
The new design gives a simpler, cleaner installation, and saves weight, Vickers says.



British Beverley Opens Cargo Doors

The large clamshell cargo doors of the four-engine Blackburn & Universal Beverley freighter open, giving a close view of the plane's loading area. Inside the fuselage is strapped a large water-ballast tank. The Beverley, 20 of which have been ordered by the RAF, can take off from 1,000-ft. runways and carry 25 tons of cargo.

NEW AVIATION PRODUCTS



VERITHERM comes in portable case.

Device Tests Tailpipe Temperature Systems

A new portable test set troubleshoots and calibrates turbojet exhaust temperature systems without engine runup, according to its manufacturer, G. F. Kelk & Co.

The Veritherm set is designed for checking military aircraft, Kelk says, but also may be used to test tailpipe temperature systems in commercial jet aircraft.

Here are the steps used in the Veritherm test:

- Electric heater units, containing temperature-sensitive elements, are slipped over the exhaust temperature probes.
- Heat is applied to the thermocouples by means of the control unit, and the resulting temperature is read.
- Cockpit instrument or exhaust temperature control is checked.
- Ground leakage test is made while the thermocouples still are hot by turning a switch in the control unit.

Kelk says its 28-lb. test set has a range of zero to 800C or 400-1,400F and has an accuracy of within 30C.

G. F. Kelk & Co., Toronto, Canada.

New System De-Ices Jet Engines, Planes

Cook Electric Co. has developed a new device that automatically de-ices aircraft turbojet engines and also can

DE-ICER protects engines, airframes.

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THE Warner Division of Detroit Harvester Company has moved into a new and larger manufacturing plant.

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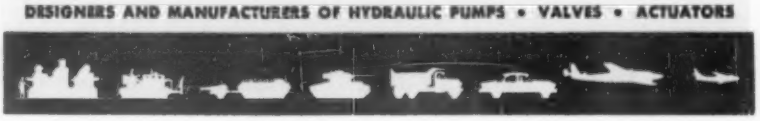

IN 1 Complete Telemeter PACKAGE

BY

BENDIX - PACIFIC

These compact, rugged FM/FM telemetering packages are available for many types of applications. Numerous models of plug-in subcarrier oscillators and associated components are available as standard equipment to provide for maximum versatility and efficiency.

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RECTANGULAR CONFIGURATION

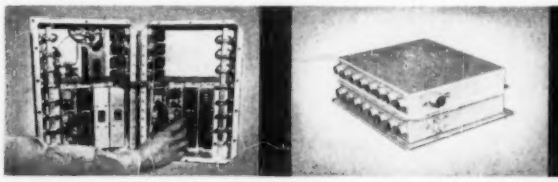
Horizontal Components

CYLINDRICAL CONFIGURATION

Wedge Shaped Components

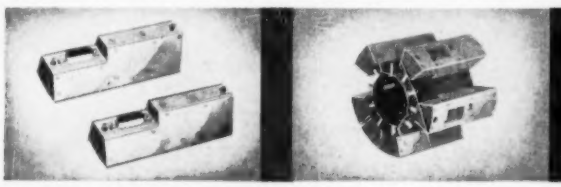
Compact Four Band Telemeter, Models TATP-3 and TATP-4

These packages, each incorporating four plug-in subcarrier oscillators, when used with a power supply and RF transmitter, form a compact, rugged system for telemetering various functions. Each package contains its own voltage regulator and calibration relays. The packages may be combined to form an 8 or 12 band system. Each package measures approximately 4.5" in each dimension and weighs approximately 3 pounds including oscillators. Standard power supplies are available for operating up to 3 packages and a 2 watt RF transmitter. The model TATP-3 operates in any 4 of the RDB bands below 22 kc the TATP-4 in any 4 of the bands from 22 kc up.



Universal Eight Band Telemeter, Model TATP-2

Operates on any eight RDB bands from 1.7 to 70 kc permitting any combination of 8 resistance, voltage or inductance type measurements to be made by merely plugging in the proper subcarrier oscillators. The unit has provisions for mounting a model TxV-13 crystal controlled transmitter. Connectors are provided for a minimum of eight remotely located pickups. Standard power supplies are available for operation from 6, 12, 28 VDC or 115 VAC 400 cps power sources. Dimensions—14" x 12.4" x 4.75".



Cylindrical Telemeter Configuration, Model TJW-1

These packages are built up of individual 30° wedge shaped components which plug into a cylindrical mounting assembly, Model TJW-1. As many as 10 subcarrier oscillators or other components can be installed into a 6.5" circular opening, 5.5" long. A center opening, approximately 1.5" in diameter, can be utilized for cables and pressure lines. A two-watt crystal controlled RF transmitter is also available for mounting in this configuration.

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Export Division: Bendix International 205 E. 42nd St., N.Y. 17

Canadian Distributors: Aviation Electric, Ltd., Montreal 9

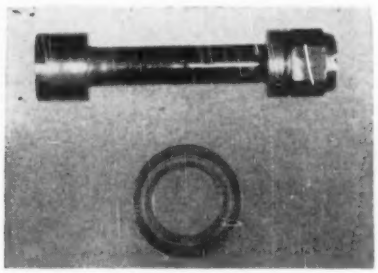
serve as a central control for external systems on airframes.

The new system has met all Air Force qualification test requirements for jet engine air duct ice detection, the manufacturer reports.

Cook says the device consists of an ice detector assembly and an interpreter assembly, requires only a source of electrical power for automatic ice detection and control.

In addition to aircraft de-icing, the maker says its new system can be modified to safeguard radar antennas and other sensitive outdoor installations.

Cook Electric Co., 2700 Southport Ave., Chicago.



WASHER is made up of steel rings.

Washer Assures Accurate Airframe Bolt Preloading

Douglas Aircraft Co. has designed a new washer to give accurate preloading of bolts during assembly of airframes, eliminating the need for torque wrenches.

The preload indicating or PLI washer, now being used on DC-6 and DC-7 assembly lines, has proved it can be designed to assure an average tension of approximately 80% of the desired bolt preload, the aircraft manufacturer reports.

The company claims this will increase the fatigue life of bolts and give tighter assemblies.

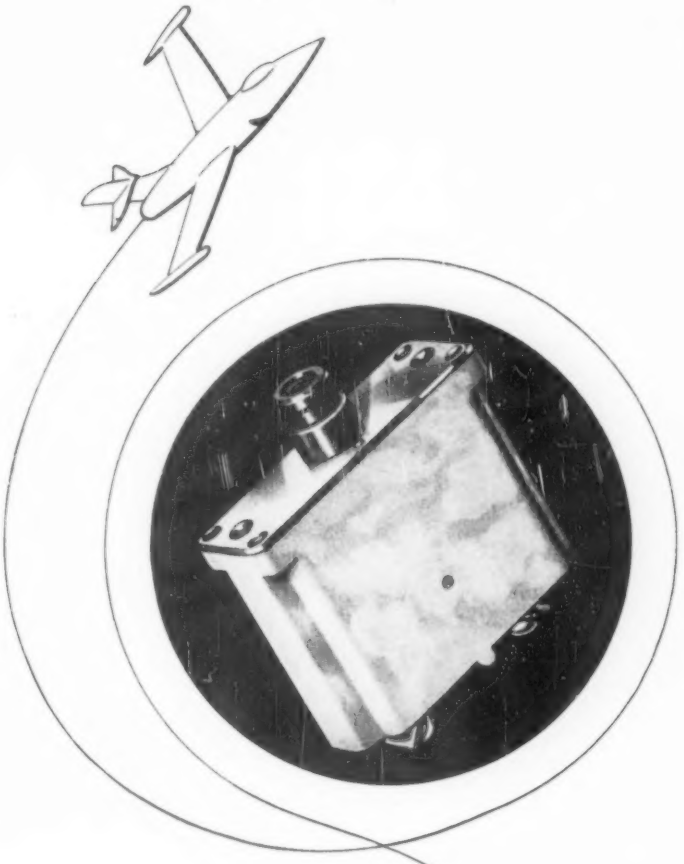
Douglas says the torque wrench techniques produces inconsistent preloads, varying from 20 to 80% of the bolt yield strength.

This new device consists of two concentric steel rings. The thick inner ring takes the load when the nut is tightened, allowing the outer ring to move freely until the desired preload has been reached. Choice of washer dimensions and material determines the load.

Workers on Douglas production lines use a disposable handle to "wiggle" the washer's outer ring during tightening operations. The handle can be shaped for easy access.

The company says its washers will be marketed as soon as licensing arrangements are completed.

Douglas Aircraft Co., Santa Monica, Calif.



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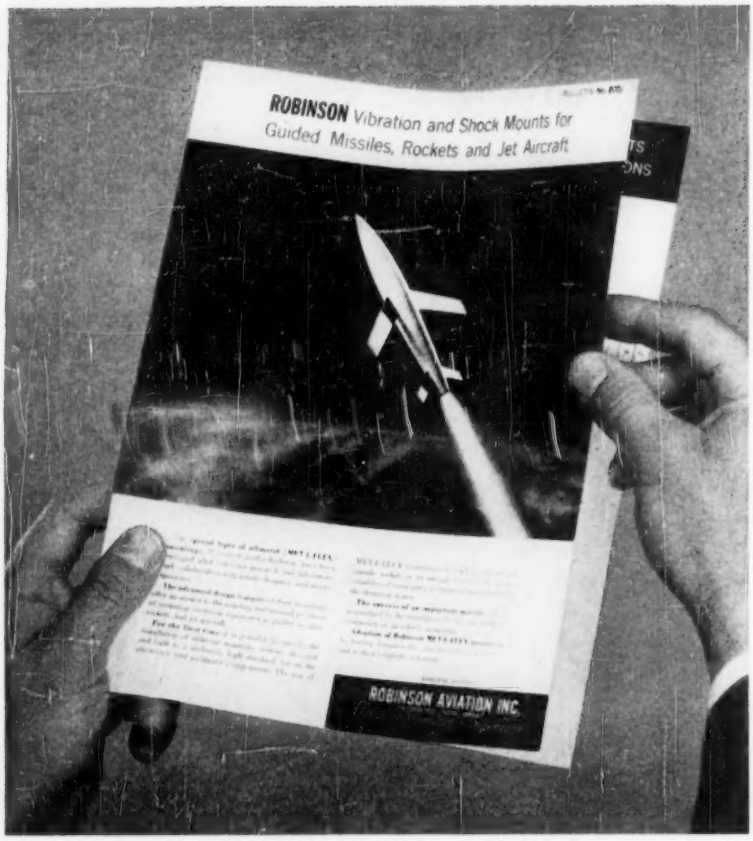

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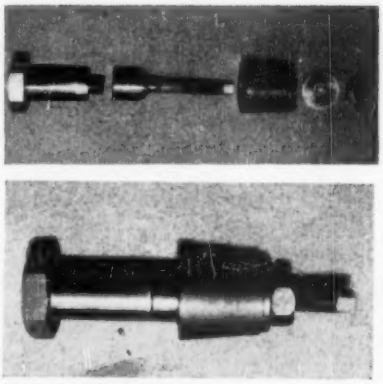


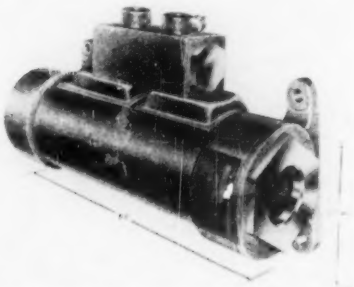
SPECIAL TOOL developed by Convair engineers for easier bolt pulling.

Bolt Puller Speeds F-102 Assembly

Wing bolts are pulled into place with relative ease on Convair Division's highspeed F-102 delta interceptor. A special bolt puller developed by Convair's San Diego tool project section does the job efficiently, eliminating the need for hammering.

An extension of slightly lesser diameter than the wing bolt is inserted in the wing root fitting to the point where the wing bolt enters the root hole. A shoulder block, washer and nut are fitted to the protruding end of the extension, which is threaded over the wing bolt end.

By merely tightening the nut, the wing bolt is drawn smoothly into place. Only change on the wing bolt is in thread diameter, to allow the extension to be fitted.



Light Heat Exchanger

This all-aluminum oil-to-fuel heat exchanger announced by United Aircraft Products, Dayton, features simplicity of design and high-efficiency heat exchange. The unit, labeled U-515335, weighs 2.1 lb., and has this performance: heat rejection—760 Btu. min.; fuel flow—1,000 lb./hr.; oil flow—30 lb./min.; maximum fuel pressure drop—23 psi. at 10,000 lb./hr. flow; maximum oil pressure drop—15 psi. at 30 lb./min. Address: United Aircraft Product, Inc., Box 1035, Dayton 1.

Rohr builds more power packages for airplanes than any other company in the world — and this picture shows the Rohr-built power packages on the wing of the big, beautiful Lockheed Super Constellation. In addition to producing power packages for the world's leading commercial and military planes, Rohr Aircraftsmen are currently making more than 25,000 different parts for all types of aircraft.

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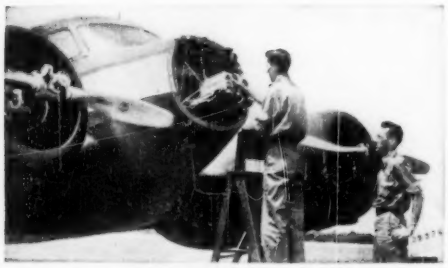
Those long, pipeline attachments on this helicopter are "guns" in the war against the insect foe, spraying death for the moth with scientific precision.

"Operation Squirt" at East Coast Aviation



CHECKING RADIO EQUIPMENT. Two Aero Tech students follow the school's guiding principle, "Learn by doing," as they check radio equipment in nose of plane.

FUTURE PILOT. Aero Tech student smiles after successful "blind flight" in Link Trainer. Many graduates are now airline captains and maintenance supervisors.

If it involves an airplane, East Coast Aviation has probably done it. Located at Bedford (Boston) Airport in Massachusetts, this unusual firm services resident and transient aircraft, operates the famous East Coast Aero Tech training school for pilots and mechanics, and participates in missions ranging from pest control to air-sea rescue. No doubt about it—East Coast planes get a work-out!

That's one reason why, for the past eight years, East Coast Aviation has used Cities Service products exclusively. Says president John T. Griffin: "We have found Cities Service Aviation Gasolenes and Koolmotor Aero Oils capable of meeting the exacting requirements of our customers and our varied operations."

There's a Cities Service product to suit your aviation needs, too. Contact your nearest Cities Service office for information.

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Civil Aviation Law Outlook:

CAA Act to Be Amended, Not Rewritten

- **McCarran hearings enter final phase, with agreement on need for nonsked and contract airline certification.**
- **But CAB opposes granting of permanent certificates to segments of industry still in developmental stage.**

Main accomplishment of two months' hearings on the 170-page McCarran Bill is that four senators thoroughly have been briefed by all sides on the nonscheduled airline issue and will watch closely developments at Civil Aeronautics Board.

CAB action on this issue, whatever it may be, is sure to have repercussions on Capitol Hill next year. The nonsked question and the future role of North American Airlines, in particular, dominated sessions of Senate Interstate and Foreign Commerce Committee on the McCarran measure.

▶ **Committee Record**—Members of the committee who regularly attended sessions and showed a substantial interest in the future of contract and irregular carriers: Sens. John Bricker, chairman; Andrew Schoppel, Mike Monroney, and George Smathers.

The two Democrats, Monroney and Smathers, indicate they look with favor on the nonsked position. Schoppel appears to lean toward the scheduled airline position.

Committee chairman Bricker's questions were noncommittal.

The hearings will finish this week in a final session with CAB Chairman Chan Gurney and CAB member Joseph Adams.

The committee has accomplished what it set out to do: acquire a record concerning the need for changes or updating of civil aviation law.

▶ **No New Law**—The hearings developed these two areas of general agreement:

- There is no need for a wholesale rewrite of aviation law, as contemplated in the McCarran Bill. Whatever legislation is considered desirable should take the form of amendments to the 1938 Civil Aeronautics Act. A new law would mean starting from scratch to build a body of legal and judicial opinions interpreting it.
- Nonskeds and air contractors should operate under CAB certificates. Difference between scheduled and nonsked factions is over the type of proceeding and criteria for obtaining certificates and the limitations to be laid down for operating authority.

The question of "grandfather rights" appears to be mainly a matter of government vs. industry. Local service airlines, nonskeds, contract carriers and airfreight forwarders each made strong bids for permanent certificates. But CAB opposed the permanent certificate for segments of the industry still in developmental stages.

Highlights of testimony by closing witnesses:

- **Former Sen. Joseph O'Mahoney,** representing North American Airlines, proposed a joint congressional "watchdog" committee "to check future abuses by the CAB of the 1938 CAA Act."

He suggested the term "irregular carrier" was developed by the Board" probably because of the belief that the word 'irregular' was ideally calculated to spread abroad the superstition of inefficiency, rude arrogance and a deliberate intention to avoid the law.

"Give a dog a bad name is the theory under which they have been kicking us around," he said.

O'Mahoney argued that Congress never intended a classification of airlines as "irregular."

"There is clearly no right in the Board to deny a certificate to any carrier engaged in air transportation if it is fit, willing and able and a public convenience and necessity exists," he testified. "Its only power is to determine what the terms and conditions of a certificate shall be."

Declaring that the recommendations of Air Coordinating Committee's recent report "have not yet attained the dignity of recommendations by the President," O'Mahoney criticized Commerce Undersecretary for Transportation Robert Murray's "advocacy of a policy of merger and consolidations by which a new air map of the U.S. is to be drawn and the industry so consolidated and controlled that the door would be permanently shut to all investors who might desire to enter."

- **Alexander Hardy,** assistant vice president of National Airlines, sharply challenged O'Mahoney.

"It distresses me," he told senators, "when I consider . . . a former champion of fair play contending that the North American combine should be rewarded for its wholesale violation of the law by being singled out as the only carrier in the U.S. to receive the authority to operate all of the major routes in the nation without showing a need for such service in a CAB proceeding. . . . He contends that this defiance of the law should be rewarded by Congress. . . .

"North American openly admits and brags that they are violating the law," Hardy said.

- **H. B. Johnston,** president of Aircoach Transport Assn., urged that "the independent lines be put on a permanent footing under some type of air carrier certificate, rather than exemptions merely. This has long been needed so these lines can project their plans, their sales programs and their financing on a long-term rather than a hand-to-mouth basis."

However, he also urged continuation of CAB's exemption authority, "under which the independent airlines were allowed to start. It has the merit of having worked." On this point Johnston differed with O'Mahoney, who claimed the exemption authority was intended by Congress to be applied only to fixed-base operators.

Johnston emphasized the need for great flexibility in the operating authority of nonskeds and contract carriers that should be ready to take care of whatever immediate demand develops.

To illustrate his contention that aircoach service still is "grossly inadequate" to serve the demands of lower-income travellers, Johnston presented this picture:

Railroads and intercity bus lines operate five times as many passenger-miles in coach service as in first-class.

But in air transportation, he said, more than twice as many passenger-miles are devoted to deluxe service compared to coach by both scheduled and nonsked lines.

His figures for 1953, in passenger miles:

	Deluxe	Coach
Rails & buses	8 billion	39 billion
Airlines	11 billion	5 billion

- **Orvis Nelson,** president of Transocean Air Lines, emphasized that non-

skeds are in a more favorable position than scheduled lines—because of the government insistence on caution that goes with government backing—to promote aviation by experimenting with new economic practices and to test public demand and acceptance.

"The very fact that the enfranchised carrier must observe the strictest possible economics and the greatest possible efficiency in adapting available capacity to available traffic," he said, "demonstrates in itself that such a carrier is not capable of response to sudden demand or to marked deviations in weekly or seasonal traffic flow over its route."

• **William A. Patterson**, president of United Air Lines, vigorously opposed giving CAB the authority to regulate the issuance of airline securities. The Board wants this authority.

"Inherent in the approach of those who urge this control," he stated, "is the assumption that airline management either stands to gain through the creation of an unsound financial structure or is incompetent to manage the finances of the airline."

If management is to be held accountable, he added, "it should not be forced to surrender its power of decision to a government bureau."

PAA Shows Training Film for Pilot Checks

Pan American World Airways has developed a training film for qualifying pilots on visual airport checkouts and estimates the new method would save the air transport industry "millions of dollars" if approved by Civil Aeronautics Board.

Capt. Kimball J. Scribner, chief pilot for PAA's Atlantic Division and director of the four-year project, says the wide-scope film would give pilots a more complete picture of airports than the present qualification flights required by Civil Air Regulations.

He forecasts the new training medium also would aid noise abatement programs.

► **Favorable Reaction**—CAB and Civil Aeronautics Administration were "favorably impressed" when Pan American showed its one-hour film of New York's LaGuardia Airport this month in Washington, D. C., Capt. Scribner reports.

He says Air Line Pilots Assn. was "enthusiastic" in its reaction to the new training method.

If approved by the Board, wide-scope movies would replace actual letdowns and takeoffs a pilot must make every 12 months under visual flight rules or with a check pilot at each regular, provisional or refueling airport on his trip.

"The fallacy of this (flight) system," the PAA chief pilot says, "is that the weather usually prevents good visual familiarization with the airport."

► **Industry Library**—Scribner believes a library of films covering each U. S. airport used by airlines could be made available to carriers for purchase or on a rental basis.

"Such a library would save the industry millions," he predicts.

Pan American officials point out the films would free equipment and check pilots from approximately 200 qualification flights annually at every field, decreasing training expenses and cutting airport area noise.

They also say pilots could give their undivided attention to the film and narration on characteristics of the airport, surrounding terrain, check points and preferred traffic patterns in the noise abatement programs.

Gurney Proposes New Airline Safety Teams

Civil Aeronautics Board Chairman Chan Gurney says the air transport industry could better its safety record by setting up a group of experienced aviation safety counselors to make constant checks on individual airline practices.

"The group would be made up of a small number of experienced pilots, aircraft engineers, maintenance experts and operations people—all with a keen imagination and a fine nose for accident potentialities, he told the Airline Operation Conference at Williamsburg, Va.

"They would operate as a team or as several teams."

► **'Safety Audit'**—Function of the group, the CAB chairman says, would be to ride the airlines, observe operations procedures, study pilot training programs and maintenance practices. As Gurney sees it, the group's objective would be to make at least one annual "safety audit" of each participating airline and issue a confidential report to the carrier.

"Membership of the group would be culled from different air carriers, each with a different safety background," says Gurney, "with the result that each individual would have a different approach and their composite talents would be brought to bear on all safety matters.

"This experience would be rapidly expanded as they made the tour around the airline network of the country. Their only function could be accident avoidance."

Gurney adds that the industry group would not need to "duplicate the splendid work" done by Flight Safety Foundation, Cornell University or the National Advisory Committee for Aeronautics. Investigation of accidents would be only a minor part of their activities, he explains.

► **Advantages**—"I firmly believe that a group of men with imagination and extensive aviation backgrounds, who are trained to think in terms of accident avoidance, could be a great boon to the industry in improving overall safety," he says.

"The Board's experience in its accident investigation work bears this out, I believe. It is extraordinary the number of times that a slip in training procedures, a slight defect in airworthiness design or improper operation techniques are involved in accidents to airline aircraft."

An industry-sponsored program would be more successful, he says, because:

• Industry could afford to pay safety counselors a salary more commensurate with their worth, insuring recruitment of the best possible talent.

• Airlines would tend to deal with such a group as part of the family rather than as a governmental agent.

• Safety must come from within. It must be a program sponsored by industry and thoroughly supported by industry to make it work.

Pioneer Puts 2-0-2 Back on Texas Route

Pioneer Air Lines has re-inaugurated Martin 2-0-2 Pacemaster service over a 442-mi. segment from Houston, Tex., to Midland-Odessa via Austin and San Angelo twice daily.

Passenger traffic on this segment has increased to the point where it is impossible to handle it with 21-passenger DC-3s, the airline says.

PAL leased the 2-0-2 from Pioneer Aeronautical Services, a separate company set up by the airline last year to take the Martin transports after Civil Aeronautics Board disallowed PAL's petition for a higher mail rate lease on 2-0-2s (AVIATION WEEK Oct. 5, p. 80).

Pioneer Air Lines' new schedules represent a 6% increase in plane-miles and a 19% climb in available seat-miles. Of PAL's 10,804-mi. daily schedule, the Pacemaster will handle 16%.

Two of the flights between Dallas-Ft. Worth and Midland-Odessa will result in improved service because of a recent CAB ruling allowing PAL to make only three stops on this segment on all flights exceeding the minimum service pattern, says Harding L. Lawrence, vice president-traffic and sales.

S&WA Connie School

Seaboard & Western Airlines has established flight and ground training school for its crews assigned to Lockheed Super Constellation airfreighters at New York's Idlewild International Airport. Delivery of the first Super Connies is expected in July.

39 Scheduled Lines Win Safety Awards

Thirty-nine scheduled U.S. airlines have received safety awards from the National Safety Council for operating without a passenger or crew fatality during 1953.

Earl D. Johnson, president of Air Transport Assn., calls this "a real testimony to the men who have designed and built and the men who operate and maintain our transport planes."

▶ **Fatality Record**—Johnson points out that in the 12-month period from June 1953 to May of this year, the scheduled airlines have flown more than 32.5 million passengers more than 18.7 billion passenger-miles with a fatality rate of .18 per hundred million passenger-miles.

Passenger fatality rate in 1953 was .56 deaths per 100 million passenger-miles for domestic operations. The best previous rate was .35 in 1952. Four fatal accidents in domestic operations in 1953 cost the lives of 101 persons—86 passengers and 15 crew members.

International operations of U.S.-flag carriers resulted in one other accident and two additional passenger deaths.

▶ **Award Winners**—Airlines receiving NSC's award for 1953 and their years of safe operation:

• **Trunklines.** Braniff Airways, 14; Capital Airlines, 4; Caribbean-Atlantic Airlines, 11*; Colonial Airlines, 23; Continental Air Lines, 18; Mackey Air Transport, 1*; Northeast Airlines, 20; Northwest Orient Airlines, 2; Pan American World Airways, 1; Pan American-Grace Airways, 10; Trans World Airlines, 3; United Air Lines, 2; Uraba, Medellin & Central Airways, 13*.

• **Territorial lines.** Alaska Airlines, 2; Alaska Coastal Airlines, 4; Byers Airways, 3*; Cordova Airlines, 2; Ellis Air Lines, 7*; Hawaiian Airlines, 24*; Northern Consolidated Airlines, 6*; Pacific Northern Airlines, 7*; Reeve Aleutian Airways, 5*; Trans-Pacific Airlines, 4*; Wien Alaska Airlines, 1.

• **Local service lines.** Allegheny Airlines, 4*; Bonanza Air Lines, 4*; Central Airlines, 4*; Frontier Airlines, 7*; Lake Central Airlines, 4*; Mohawk Airlines, 3; North Central Airlines, 5*; Ozark Air Lines, 3*; Piedmont Airlines, 5*; Pioneer Air Lines, 8*; Southern Airways, 4*; Southwest Airways, 2; Trans-Texas Airways, 6*; West Coast Airlines, 7*.

• **Cruise lines** (scheduled). Resort Airlines, 3*.

* No fatal accident from date of airline establishment or first record.

Government, Airlines Split on Offset Issue

Government and industry are split on the question of whether domestic airline profits should offset subsidy requirements for international operations.

The Post Office Department strongly opposed legislation introduced by Sen. Pat McCarran, that would authorize Civil Aeronautics Board to consider air-mail rates and subsidy payments separately for the different divisions of air carriers.

▶ **$15.7-Million Saving**—A Supreme Court decision held that, under the 1938 CAA Act, the Board had to determine mail rates and subsidy by the "entirety" of an airline's system (AVIATION WEEK Feb. 8, p. 13).

The Post Office estimated that more than $15.7 million in mail and subsidy payments could be saved by application of the offset principle established by the court decision to three carriers: Delta-C & S Air Lines, $2.1 million; Pan American World Airways' Atlantic Division, $1.8 million; Trans World Airlines, $11.8 million.

CAB supported the measure. Chairman Chan Gurney contended that domestic-foreign carriers should be treated similar to their all-domestic competitors on their domestic operations and similar to their all-foreign competitors on their foreign operations.

▶ **Presidential Policy**—The official Administration position has not been disclosed. Neither the Post Office nor the CAB position was approved by the Bureau of the Budget as being "in accord with the program of the President."

Four domestic-foreign airlines plan to testify before Senate Interstate and Foreign Commerce Committee urging enactment of the measure invalidating the Supreme Court decision. They are: Braniff Airways, TWA, Northwest Orient Airlines, and Delta-C & S.

Pan American, Panagra and Seaboard & Western Airlines are scheduled to testify in opposition.

Boeing Insures 707 For $6.5 Million

Boeing Airplane Co. has taken out $6.5 million in all-risks hull insurance to cover its new four-jet Stratotanker-Stratoliner prototype transport during ground and flight tests, expected to take two and a half years.

The insured value is said to be an all-time high for aviation underwriters, tripling the previous record for a single airplane.

The insured aircraft is designated Boeing Model 367-80, which the manufacturer commonly refers to by the-less-complicated, easier-to-remember designation, 707.

E. R. Bowden of Bowden, Gazzam & Arnold, Seattle, Wash., represented Boeing in placing the insurance. United States Aircraft Insurance Group covers 50% of the value, with re-insurance support from eight other casualty company members.

The remaining 50% was covered by the Insurance Co. of North America, Aero Associates and the London market.

Spanish Super Connie for Madrid-N. Y. Service

Here is the first of three 63-passenger Lockheed Super Constellations delivered to Iberia, Airlines of Spain, and dedicated June 23 during ceremonies at New York's International Airport. Iberia has applied to Civil Aeronautics Board for authorization for Madrid-New York service and hopes to start this operation Aug. 4. The first Iberian Super Connie is named the Santa Maria; the others will be called the Nina and Pinta after Columbus, famed tiny fleet. All will be powered by Wright Turbo Compounds.

ATA Board Approves $650,000 Budget

Air Transport Assn.'s board of directors has approved a $650,000 budget for the organization's operations from July through December of this year. Budget figure for the first six months of 1954 was $595,000.

J. H. Carmichael, president of Capital Airlines, was elected to the board, replacing Harold Harris, former Northwest Orient Airlines president, who resigned.

E. J. Kelly, executive secretary of the Airline Finance and Accounting Conference of ATA, was elected vice president of the organization.

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Airline Strikes

- **ALPA threatens walkout over 8-hr. flight waiver.**
- **Action could paralyze American, UAL, TWA.**

Three of the nation's Big Four airlines faced the possibility of a pilot strike last week in the wake of Civil Aeronautics Board's decision to lift temporarily the 8-hr. domestic flight time limit to 10 hr. (AVIATION WEEK June 21, p. 16).

Strike ballots went out first to pilots of American Airlines from Air Line Pilots Assn. And, by the end of the week, were scheduled to be sent to United and Trans World Airlines pilots.

An affirmative vote by pilots of all three lines presumably could halt flight operations of the three carriers.

▶**AA Warning**—O. M. Mosier, senior vice president of American, telegraphed J. J. O'Connell, chairman of AA's master executive council of ALPA: "We take exception to your advising pilots of so-called violations of regulations in respect to flights lawfully permitted by CAB decision that carefully considered safety and all other factors involved.

"Any pilot acting on your advice," Mosier warned, "will be considered as violating his obligations as an employee of American."

United indicated similar views.

If pilots of all three airlines voted to strike, ALPA said, the machinery of a walkout could be thrown into action within 24 hr.

▶**ALPA Petition**—Meantime, CAB had not come to any decision last week on ALPA's petition for reconsideration of the waiver ruling.

"The Board has permitted insufficient time to acquaint itself with the technical aspects of the problem and is unjustified in permitting the waiver upon the record in these proceedings," the pilots' union said in its petition.

"No emergency exists that could possibly justify this hasty and ill-conceived action by the Board."

ALPA charged that CAB by its action "condoned American Airlines' disregard of the law," which the union maintains has been the case since AA first scheduled its DC-7 in nonstop transcontinental service.

The Board's decision, ALPA said, raises the following questions:

- Is it CAB's intent that a pilot may fly an unlimited number of hours continuously providing only that he may not be scheduled to fly more than 10 hr.?
- What is the responsibility of the pilot after 10 continuous hours of flying—in the event of an accident?
- If the exigencies of a particular flight require a landing enroute, is the pilot governed by the 8-hr. or the 10-hr. maximum?
- If a pilot, after two hours enroute, experiences a mechanical difficulty necessitating a return to point of departure and is delayed there for four hours, may he still depart on his scheduled 10-hr. flight as under the present 8-hr. rule?
- If the pressurization equipment is inoperative for a particular flight, may the pilot nevertheless depart on a 10-hr. flight?
- Is there any limit to the number of hours a pilot may be required to remain continuously on duty or fly as long as he is scheduled for less than 10 hr.?
- Is there any limit to the number of landings a pilot may make enroute as long as the flight is normally scheduled to be nonstop?

Meantime, ALPA was preparing a bill to be introduced in Congress limiting flight times for domestic pilots to 8 hr.

▶**Extended Schedules**—Success of the request for a waiver of the regulations prompted American to extend its 7 hr. 55 min. New York-Los Angeles schedule to 8 hr. 35 min. American also put into service a third nonstop DC-7 flight between New York and Los Angeles. Beginning July 1, AA will provide nonstop DC-7 service between Washington, D. C., and Los Angeles.

TWA, flying two Super Constellation flights nonstop coast-to-coast, was expecting to draw off some of the business lost to American's DC-7 service before the waiver went into effect.

During the first few days of operation, TWA said it was making the east-west flight in times varying from 8 hr. 16 min. to 8 hr. 51 min.

United has one DC-7 nonstop round-trip flight scheduled and has no immediate plans for extending it. UAL also is operating one DC-7 nonstop flight from San Francisco to New York.

'Champagne' Flights

Los Angeles—Western Air Lines' champagne-and-orchids service on its DC-6B Californian flights has gained such popularity that WAL has doubled the trips from Los Angeles to San Francisco, Portland and Seattle-Tacoma.

The luxury flights were inaugurated approximately a month ago (AVIATION WEEK June 7, p. 114) to compete with Stratocruiser service offered by United Air Lines on the same route.

In addition to the flight leaving Los Angeles International Airport nightly, the airline now has a mid-day trip on which patrons enjoy the same ultra-plush service.

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We have the know-how and the special equipment to make every job a perfect job . . . absolutely WASTE-Resistant . . . a factor worth looking into! Next time you need seamless or welded cold drawn Stainless or alloy tubing in sizes .050" to .625" O.D., specify TMI and see for yourself.

The Mark of Quality TMI

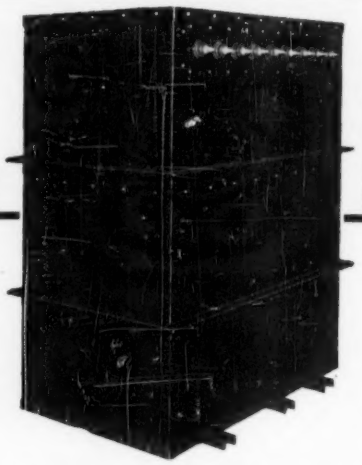
Next time specify TMI, one of the most respected names in the tubing field today.

TUBE METHODS INC.

METALLURGISTS • ENGINEERS • MANUFACTURERS

BRIDGEPORT (Montgomery County), PA.

CUSTOM BUILT TRANSFORMERS



Here is an example of the type of equipment we can build to specifications for research, laboratory or experimental work. This Acme Electric custom built transformer has a primary that can be varied from 12 volts thru 115 volts, with a frequency range from 7 cycles thru 60 cycles. Nominal output voltage, 33,000 volts.

This unit was built for use in connection with high voltage electrostatic separation and collection of various types of atmospheric particles.

Designing a Dry Type transformer in this voltage class that provides safe and efficient performance, is another notable example of Acme Electric transformer engineering.

ACME ELECTRIC CORPORATION

MAIN PLANT: 857 WATER STREET • CUBA, N. Y.

West Coast Engineering Laboratories: 1375 W. Jefferson Blvd. • Los Angeles, Calif.
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Company_____

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CAB ORDERS

(June 4-10)

EXTENDED:

United Air Lines present exemption to fly property between Los Angeles International Airport and Lockheed Air Terminal at Burbank, Calif., for three years.

GRANTED:

Western Air Lines an exemption to fly property between Los Angeles International Airport and Lockheed Air Terminal.

Public utilities commissioner for state of Oregon leave to intervene in States-Alaska case.

Flying Tiger Line an exemption to fly three flights of passengers for the Intergovernmental Committee for European Migration from Brussels, Belgium, to New York on or about June 8, June 22 and July 6; three flights from Munich, Germany, to New York on or about June 15, June 29, and July 20; one flight from Stockholm, Sweden, to New York on or about July 13 and one flight from either Brussels or Munich to New York on or about July 27.

APPROVED:

Agreements between Pan American World Airways and various other air carriers relating to a sleeper surcharge as adopted by International Air Transport Assn.

Five-year lease of one Super Constellation by Seagull Air Transport Corp. to Seaboard & Western Airlines.

101 Viscounts

Orders for the Vickers-Armstrongs turboprop Viscount transport have reached 101, the company reports.

Butler Air Transport, Ltd., of Australia, ordered two Viscounts with an option for an additional four just two weeks after Capital Airlines ordered three with option for 37 (Aviation Week June 14, p. 16).

Orders to date:

British European Airways	38
Air France	12
Aer Lingus	4
Trans Australia Airlines	6
Trans-Canada Air Lines	15
British West Indian Airways	4
Hunting-Clan Air Transport	3
Iraqi Airways	3
Fred Olsen Air Transport (Norway)	2
Indian Air Force	2
Canadian Department of Transport	1
Misrair (Egypt)	3
LAV (Venezuela)	3
Capital Airlines	3
(option on 37)	
Butler Air Transport	2
(option on 4)	
TOTAL	101

Interlocking relationships created as a result of Laurance S. Rockefeller serving as a director of Eastern Air Lines and as a stockholder and nominator of directors of Wallace Aviation Corp., which designs, develops and manufactures rolled compressor and turbine blades for turbine powerplants for U. S. armed services.

Reciprocal ground services agreement between Ellis Air Lines and Alaska Coastal Airlines at Ketchikan and Juneau, Alaska, for an indefinite period.

Intercompany agreements between Northeast Airlines and Riddle Airlines and various other air carriers.

Intercompany agreements between Pan American World Airways and Caribbean Atlantic Airlines and various other air carriers.

AUTHORIZED:

Forest Protection, Ltd., to operate a Cessna 170 Canadian registered aircraft in spraying operations on a Maine spruce budworm project being administered by the state of Maine.

AMENDED:

Mohawk Airlines' service pattern by omitting Auburn-Geneva, N. Y., on flights in excess of one daily roundtrip; omitting service to Rochester, N. Y., on flights between Auburn-Geneva and Buffalo; and omitting service to Syracuse, N. Y., on flights between Auburn-Geneva and Utica-Rome; and to omit service to two of the three points—Ithaca, Binghamton-Endicott-Johnson City or Elmira-Corning, on flights it presently operates between Auburn-Geneva and New York.

DENIED:

North American Airlines' motion that its application for a certificate of public convenience and necessity authorizing service from New York, Philadelphia, Cleveland and Detroit, to Kansas City, Denver, Los Angeles and San Francisco be consolidated into the Denver service case and an alternative motion asking that the case be restricted to service from gateway cities, such as St. Louis and Chicago to Kansas City, Denver, Salt Lake City, San Francisco and Los Angeles.

United States Overseas Airlines' petition for rehearing and reconsideration of its original application requesting a certificate of public convenience and necessity to conduct supplemental or limited scheduled air transportation of cargo and a limited number of passengers on a space available basis between New York and certain points in Northern Europe and along the Mediterranean and consolidation or contemporaneous consideration of the severed portion with the trans-Atlantic cargo case.

ORDERED:

An investigation to determine whether the Board should order temporary suspension of air service of Braniff Airways at Galveston, Tex., for as long as the city is served by Trans-Texas Airways.

Parks Air Lines to show cause why the Board should not fix mail rates for its operations between Sept. 15 and Sept. 25, 1950; and why so much of its petition, filed July 17, 1950, as relates to the fixing of a final mail rate for the period June 23, 1950 through Sept. 14, 1950, should not be dismissed with prejudice.

DISMISSED:

Pan American World Airways application for renewal of a temporary exemption authorizing an aircoach configuration over the Pacific Northwest-Hawaii segment of through flights operating south or west of Hawaii.

Friedkin Aeronautics, Inc., doing business as Pacific Southwest Airlines, application for a certificate of public convenience and necessity authorizing scheduled transportation of passengers property and mail.

SHORTLINES

► **Air France** has added Bangkok, Thailand, as a Paris-Tokyo stopover.

► **KLM Royal Dutch Airlines** has begun trans-Atlantic DC-6B service from Amsterdam to Lima, Peru, Curacao and Panama City. . . . KLM has named its 13th Convair 340 the Jan Van Eyck after the 15th Century Flemish painter. . . . The carrier has a corps of stewards who specialize in the handling of animals on flight.

► **North Central Airlines** has shattered its single-day traffic record, carrying a total of 1,054 passengers on the system. This is 100 more passengers than had been flown on any previous single day.

► **Pan American World Airways** is retiring Capt. Norvel O. Carmichael after 37 years of flying, 22 of which he spent with PAA. He has flown more than 6-million mi. and logged 30,000 flying hours.

► **Scandinavian Airlines System** has added a third weekly flight to Japan and the Far East. SAS also has added three new cities on the Far East run—Dusseldorf, Abadan and Hong Kong.

► **Swissair** has inaugurated once-a-week service between Zurich and Sao Paulo, Brazil, its first route to South America. Flights will stop at Geneva, Lisbon, Dakar, Recife and Rio de Janeiro.

► **Transocean Air Lines** has leased two DC-4s from Trans-Canada Air Lines, bringing to 13 the number of DC-4s TAL will have in operation this summer. Transocean also has won an Army contract to transport approximately 3,000 military dependents from the Far East to California.

► **United Air Lines** has opened a school in Tokyo to train Japanese travel agents in tariff interpretation and airline ticketing procedures. . . . Is offering 23% greater seating capacity this spring than in 1953 by offering a total of 13,725,000 seat-miles daily and doubling its aircoach capacity of a year ago.

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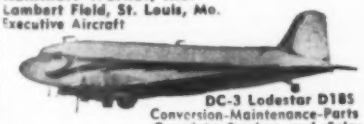

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Airframe spares for the following aircraft: Convair C240 and 340; Constellation 049, 749, 1049; Douglas DC-6 A & B, DC-4, C-47; Boeing 377. Engine spare parts for P & W 2000, 2800, 1830; Wright Cyclone R.D.1. BA 3. C.A.B. Ltd., 49, Old Bond Street, London, W.1. Phone, Mayfair 0035. Cables, "Contaero, London".

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Sikorsky Aircraft, foremost designer, developer, and manufacturer of helicopters, is increasing its production of the latest type, combat-proved helicopters and is expanding its research and development program.

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Division of United Aircraft Corporation

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Attractive Positions with

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IN DALLAS, TEXAS

For Details See

JUNE 21 AVIATION WEEK

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Mechanical or Aeronautical

A very progressive development laboratory has several opportunities for experienced men for commercial product development in the field of high speed turbo machinery. If your background includes experience in turbo chargers, compressor or gas turbines reply in full giving training, work experience and other pertinent facts. Men with high degree of initiative, creativeness, ability and responsibility will find opportunities among these personnel needs. Salary plus other benefits. Excellent laboratory equipment and working conditions. Personal interview arranged at your convenience.

P-3141, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

SUPERVISOR OF AIRFRAME COST ESTIMATING

Reliable, established mid-west firm engaged in the manufacture of airframe assemblies needs a man with a heavy background in aircraft cost estimating.

Experience must be sufficient to prepare bids and supervise a cost estimating department. State experience, education, salary and age in first letter.

P-3108, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

DESIGN DRAFTSMEN

These engineering opportunities are on leading commercial aircraft project.

HELIO AIRCRAFT CORPORATION
Boston Metropolitan Airport
Norwood, Massachusetts

IF there is anything you want . . .

that other readers of this paper can supply

or—

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that other readers can use, advertise it here—in the

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Clear Horizons ahead

. . . at Goodyear Aircraft Corporation

BUILD YOUR CAREER and help build tomorrow's world with the pioneer and leader in lighter-than-air craft. There's a clear, bright future at Goodyear Aircraft for engineers with talent, aptitude and ambition.

FORCEFUL, CREATIVE THINKING is the key to Goodyear's progressive research and development programs in missiles, electrical and electronic systems, servomechanisms, new special devices and fiber resin laminates. Design and development engineering opportunities are many and varied . . . are now available to capable and imaginative men and women in the field of airships, aircraft and aircraft components.

POSITIONS ARE OPEN in several fields with salaries based on education, ability and experience.

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Mechanical engineers	Welding engineers
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Openings also exist for personnel with ability and experience in technical editing and writing, art, and motion pictures.

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THE TIME TO PLAN A CAREER IS - NOW! Write, giving your qualifications, or requesting an application form.

C. G. Jones, Salary Personnel Department

GOODYEAR AIRCRAFT CORPORATION

AKRON 15, OHIO

GOODYEAR AIRCRAFT

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In the B-47 and B-52 PROGRAMS

For Engineers with 3 Years or More of Analytical Design Experience in

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- Air Conditioning
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Send Resume to R. J. B. Hoffman, Admin. Engr., Boeing Airplane Company, Wichita, Kansas

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is offered for intelligent, imaginative engineers and scientists to join the staff of a progressive and self-sustaining, university-affiliated research and development laboratory. We are desirous of expanding our permanent staff in such fields as design studies of advanced supersonic aircraft, analytical and experimental studies of aeroelasticity, helicopters, aircraft structures, control and stability, large scale wind tunnel testing, and in various other applied research fields of aeronautics.

Salary structure and benefit programs are on a par with industry. In addition, there are many tangible advantages, such as our self-sponsored internal research policy, of interest to men with ingenuity and initiative.

CORNELL AERONAUTICAL LABORATORY, INC.
BUFFALO 21, NEW YORK

ENGINEERS
new aircraft projects at **RYAN**

IMMEDIATE OPENINGS FOR

Aerodynamicists
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Engineering Designers
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Replies to Administrative Engineer will be held in strict confidence

RYAN
AERONAUTICAL COMPANY
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ENGINEERS
(Career Opportunity)

Important Aircraft Engine Accessory Manufacturing Company in Central Connecticut, has openings for graduate engineers in their Project Engineering Department.

1. Require men to set-up and perform system analysis by use of analogue computer equipment. With background of servo theory for dynamic analysis of feedback control systems, as applied to turbojet and turboprop engines.

2. Men with background in fluid mechanics to work on hydraulic control development and fuel systems for turbojet engines. Required to execute design and performance analysis for steady state and transient conditions. Also have several interesting openings for recent Mechanical and Electrical Engineering graduates.

Ideal suburban location for working and living. Send resume of education, experience and salary requirements.

P-3069, Aviation Week
330 W. 42 St., New York 36, N. Y.

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Operating a transonic and supersonic windtunnel and combustion facility, the Aerodynamic Test Division, at the Naval Air Missile Test Center, Point Mugu, Calif. offers interesting opportunities for the following:

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EXECUTIVE POSITION in Aircraft or related field. Broad and comprehensive background in engineering and research, covering flight testing, instrumentation, performance, structures, dynamics and stability. Eight years additional experience in planning, personnel, administrative and directive situations. Graduated U.S.N.A. and M.I.T. as marine and aeronautical engineer. PW-3121, Aviation Week.

A & E MECHANIC—19 years Aircraft experience, overhaul, maintenance, Metal fabrication, layout, airline, inspection. Married, 37 yrs. old. PW-3130, Aviation Week.

AVAILABLE TO reliable co: Unique, intensive, 22 year background of aviation sales, service, export and public relations experience. Over 17 yrs. with three plane mfgrs. Extensive Latin travel, fluent Spanish. Comml. pilot, SEL, 1,500 hrs. Resourceful, capable, mature judgment. Health perfect. Dedicated promotion aviation all phases. Age 44, married, available, adaptable, relocate. PW-3110, Aviation Week.

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If you have a proven background of accomplishment in the above, it would be to your advantage to investigate the opportunities at LYCOMING

We have immediate openings for:

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Qualified applicants will be notified of personal interview. Send complete resume to:

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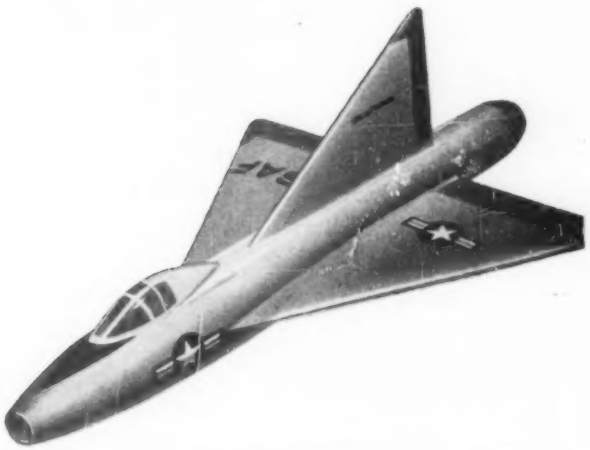

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It is, we believe, an "engineers" engineering department—interesting, energetic, explorative — with the diversity that means security for capable personnel.

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Or this: Convair's B-36 is the world's largest operational bomber, Convair's B-24 Liberator was World War II's most used heavy bomber, Convair's XP5Y-1 holds the world's endurance record for turbo-prop aircraft.

Or this: Convair has been awarded the nation's first production missile contract and the first production contract for supersonic interceptors.

Currently . . . Convair has the greatest diversity of aircraft engineering projects in the country, including high-performance fighters, heavy bombers, large flying boats, transports, trainers, seaplane fighters and guided missiles.

Currently . . . Convair has a completely integrated electronic development section engaged in advanced development and design on missile guidance, avionic projects and radar systems.

Would you like to join us? We earnestly need engineers of proven ability — men who want to make full use of their time, their minds, their skills and abilities solving the complex problems confronting us in these projects. If you are such a man, write us and we'll send you a free booklet about us, plus other interesting material to help you make the decision.

***Write:* H. T. BROOKS, Engineering Personnel Department 200**

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in beautiful San Diego, California

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POWER PLANTS—Propellers, Accessories.
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offers unusual opportunity for

ENGINEERING TEST PILOT

who meets the following qualifications:
must have

- **Engineering Degree**
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a minimum of 1000 hours helicopter flying time preferred

Send Resume To

Employment Manager
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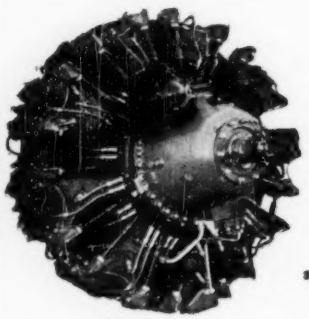

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These engines are 00:00 time since C.A.A. approved overhaul and have had ACES C.A.A. approved outside in lubrication system blower to thrust plates incorporated. They have also been block tested in our modern test cells and have been prepared for long term storage

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ACES AIR CARRIER ENGINE SERVICE, INC.

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1,000 hrs TT airframe—5 hrs since new both engines. Unlicensed but ferryable. Priced to sell.

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SIX PLACE AERO COMMANDER

PRICE, $44,000

CALL DETROIT, MICH. — TYLER 8-1000

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GE Types B-22, B-33, B-31, C-23, New and serviceable.

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EXECUTIVE AIRCRAFT

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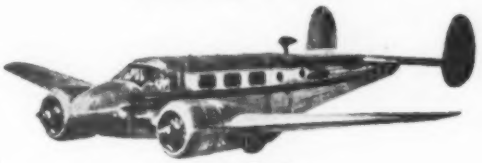

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BONANZAS

New, Demonstrators
Used, Trade-Ins

Twin Bonanza

C-47 CARGO, 1944, NTSO P&W engines, relicense. De-icers, hot air heat, dump chutes, 24 volt, wing modification, dual instrumentation. VHF, MHF, ADF, LF, ILS. $89,000.

DC-3 1942, NTSO engines. Janitrol, de-icers, Goodyear brakes, dump chutes, wing modification, 24 volt, 21 seat airline. Dual Collins omni, VHF, MHF, ADF, LF, ILS. $79,000.

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Businessman's
Blueplate Special

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Accepted in Trade on SUPER-92 DC-3

1943, 3000 hours total. BENDIX TA-18 VHF Tx., MN85 VHF Rc., NA3 VHF with OmniMag and R.M.I., MN53 Marker, dual ARN7, ADF, RTA-1B MHF. A.R.C. T-11 VHF Tx., R-15 VHF Rc. LF RC., isolation amplifier, speakers. SPERRY C2 Gyrosyn, H5 Horizon. Dual instruments, Grimes lights. WRIGHT R1820-56, new buildups. Dual fuel, down latches, dump chutes, de-icers, hi-pressure brakes. Deluxe 3 part interior, automatic heat. Many extras.

$95,000

Super-92 DC-3

New ship guarantee, complete 8000 hour overhaul, SUPER-92 engines, Collins radio, beautiful custom interior, 200 mph. All have the new Remmert-Werner exclusive large cabin and picture windows for eye level vision.

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BLUE PLATE SPECIALS
Every Month

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60,000 Feet in a DC-3

The battle of TACAN vs. VOR/DME has resulted in an Air Coordinating Committee opinion that whatever the system of navigation the United States is to use, it must, among other things, be accurate to about one degree on all 360 radials to an altitude of 60,000 ft. This is quite an order.

Few people other than pilots and traffic controllers fully appreciate the significance of accurate radio courses. Except for normal alertness against haywire operation, existing aids can be used with fair assurance that they are accurate. Were this not so air transportation could not have reached its present state.

Accuracy of navigational aids at low altitudes is not particularly surprising since they are checked the minute anything appears amiss. But what about high-altitude accuracy? Until recently, of course, there was such a scarcity of traffic at the higher levels that it really didn't matter whether an "on course" even existed. But this day is gone.

▶**Fine Agency**—As the ACC has recognized, we now need precision up high. How we are going to get this is another matter.

Having many times criticized various government agencies for ineptness, it is a happy occasion to point to a really fine one. CAA's Airways Flight Inspection, only group charged with determining the in-flight accuracy of radio aids, is a top-notch organization. One probable reason for this is that the outfit is headed by honest-to-goodness pilots. The chief, Art Jenks, is one of the true aviation wizards of the world; and his deputy, Ed Rogers, and Al Morrissey, chief of terminal aids, are tops in their fields.

It certainly is true that ground monitoring devices, propagation theories and electronic engineering calculations do a fine job of keeping radio courses close to tolerances. But the only solid-gold proof that these courses correspond to their charted position comes from a flight check.

▶**Neat Trick**—Until a few years ago, flight checking was no particular problem. Jenks, or one of his associates, simply climbed into a DC-3 loaded with recording devices and checked the accuracy. While the reliability of CAA's fleet of DC-3s and Beechcrafts is not in question, I do think it is going to be a rather neat trick to comply with ACC's 60,000-ft. directive in this equipment—even for wizards.

Actually this altitude restriction of AFI means that every airplane flying higher than 10,000 ft. is sailing in absolutely uncharted skies. Just because a radio is OK up to that height is no guarantee that it is the same at 20,000 or 40,000. Except for scattered runs by military aircraft having the proper recording instruments, there is no data on the condition of things in the realm of ACC's thinking.

▶**Tools for Job**—It is difficult to fathom this lack of modern airplanes in CAA. Besides not being able to do the job in the first place, any airline in the world will tell you that it is uneconomical to operate obsolete aircraft. Probably half of CAA's fleet of 30-odd planes could be eliminated by acquisition of a few modern ones. For safety and efficiency, it is imperative that our navaids be checked at altitudes at which they are being used.

The installation flight check of a VOR requires some 18 hours in a DC-3 and periodic checks of 3 to 4 hours, and we still don't know its condition above 10,000 ft. With some 150,000 miles of LF and VHF airways to cover, it doesn't take much bookkeeping to show that a modern, pressurized airplane would pay off. If the new ACC directive is to mean anything more than just paper talk, somebody had better consider getting the necessary tools to do the job.

AVIATION CALENDAR

July 3-5—Elmira Area Soaring Corp., Northeastern States Soaring Championships, Harris Hill, Elmira, N. Y.

July 3-6—Eighth annual All Women Transcontinental Air Race, sponsored by Ninety-Nines, Inc., Long Beach, Calif., to Knoxville, Tenn.

July 3-11—Philadelphia Glider Council, annual Open House Week; July 11-17, Glider Training Camp, both at Hilltown, (Pa.) Gliderport.

July 4—Western National Air Show & Races, including closed-course midget racer events, sanctioned by National Aeronautics Assn., Dansville, N. Y.

July 4—Sesquicentennial National Air Show, County Airport, Somerset, Pa.

July 11—Air show and dedication of Port Columbus Airport control tower, Columbus, Ohio.

July 13-15—Western Plant Maintenance Show, managed by Clapp & Poliak, Pan-Pacific Auditorium, Los Angeles.

July 22—Third National Aviation Education Workshop, sponsored by CAP and the University of Colorado, Boulder, Colo.

July 27-Aug. 5—21st National Soaring Contest, Elsinore, Calif.

Aug. 7-8—Experimental Aircraft Assn., fourth annual National Air Pageant and second annual fly-in and convention, featuring "home-built" aircraft, sportsplanes, racers and antiques, Milwaukee.

Aug. 9-10—American Society for Quality Control, first annual Western Regional Conference, to be held in conjunction with the National Conference of the Aircraft Technical Committee, U. S. Grant Hotel, San Diego.

Aug. 9-11—Institute of the Aeronautical Sciences, turbine-powered air transportation meeting, Seattle.

Aug. 25-27—Western Electronic Show & Convention (WESCON), sponsored by West Coast Electronics Mfg. Assn. and Institute of Radio Engineers, Ambassador Hotel, Los Angeles.

Sept. 4-6—National Aircraft Show, Dayton.

Sept. 7-12—Society of British Aircraft Constructors, 1954 Flying Display, Farnborough, England.

Sept. 13-24—Instrument Society of America, first International Instrument Congress and Exposition and third annual Analytical Instrument Clinic, Philadelphia.

Sept. 21-23—Society for Experimental Stress Analysis, annual meeting and exhibition, Bellevue-Stratford Hotel, Philadelphia.

Oct. 4-6—Tenth annual National Electronics Conference, Hotel Sherman, Chicago.

Oct. 5-7—Champion Spark Plug Co., 10th annual Aircraft Spark Plug and Ignition Conference, Secor Hotel, Toledo, Ohio.

Oct. 5-9—Society of Automotive Engineers, National Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 17-22—International Union of Aviation Insurers, annual general meeting, New York.

Oct. 18-22—National Safety Council, Aeronautical Section, Conrad Hilton Hotel, Chicago.

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MACHINE TOOL COMPANY
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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LETTERS

Shock & Vibration

In your Letters pages, Mr. F. A. Paul of Northrop and Mr. Maurice Gertel of Barry Corp. have discussed advantages and disadvantages of vibration isolators.

Mr. Paul has stated that vibration isolators may do more harm than good if we consider shock and resonance effects. Mr. Gertel replied, in effect, that vibration isolators are, of course, ineffective in isolating shock, and should not be used where shock is present. I fully agree, and I believe Mr. Gertel confirms, thereby, Mr. Paul's statement.

In military aircraft, both vibration and shock are present.

We have found that not only do vibration isolators amplify shock, but that all so-called shock isolators which we have tested . . . also amplify shock (the shock test used is described in MIL-E-5272A). In addition, most shock isolators exhibit undesirable resonance effects somewhere between 20 and 40 cps. However, the shock isolators do not amplify shock nearly as much as vibration isolators amplify shock. What obviously is needed is a "mechanical excitation isolator."

We are presently faced with the choice of either obtaining good vibration isolation at the expense of large shock amplification or of obtaining mediocre vibration isolation with only slight shock amplification. It should be noted that the isolator manufacturers are not entirely at fault; the space allowed for the stroke of the isolators is often insufficient to allow even an ideal isolator to attenuate shock.

In this letter, as well as in most specifications, the words "shock" and "vibration" have been used freely. If pressed for a definition, most of us would agree that the essential difference has to do with the distinction between transient impulses and steady state oscillation.

However, all records of actual behavior of an aircraft structure reveal transients of an oscillatory nature. This combines the characteristics of both shock and vibration. I wonder if your readers can suggest a more satisfactory method of distinguishing between shock and vibration, both as applied to analyzing flight records and to defining test techniques? I believe that such clarification would be helpful to the entire industry.

M. R. Seldon, Supervisor
Reliability Design Group
Chance Vought Aircraft
P. O. Box 5907
Dallas, Tex.

Breadboard Model!

I have noticed the comment by pilot Scott Crossfield in your May 24 Aviation Week on page 98 under the title, "Are Pilots Bad?"

Regarding his question, "Where can you find another non-linear servo mechanism weighing only 150 pounds and having great adaptability, that can be produced so cheaply by completely unskilled labor," I wish to remark that Mr. Crossfield, I am sure, refers only to the "breadboard" model. He will agree, no doubt, that the present mechanism has been in the development laboratory for over 20 years at a cost estimated as follows:

1. Fuel consumed (20 yr.)	$36,000
2. Development of basic servo system (6 yr.)	6,000
3. Organization and indexing of storage and filing system (12 yr.)	12,000
4. Refinement of servo system (addition of velocity feedback) (15 yr.)	45,000
5. Government furnished items—	
a) Additional refinement of servo and storage system (4 yr.)	50,000
b) Environmental control equipment, (temperature, pressure, acceleration)	25,000
c) Premium for protection of investment, (ejection seat, insurance, facilities)	25,000
6. Miscellaneous costs (20 yr.)	100,000
Total cost	$304,000

It should be noted that the resulting product is extremely fragile, has an intermittent duty cycle of ten hours on and 14 hours off, must be refueled every four hours during the duty cycle, has a poor power-to-weight ratio of 1,500 lb./hp., costs $2,000 per lb., has a maximum response of only 10 cycles/sec due to neuron transit time, is non-expendable, requires 75 cubic feet of space in the operating configuration and overheats easily.

In answer to Mr. Crossfield's question, I should like to suggest the Stephen-Douglas Co., Inc.

Kingdon Kerr
Director of Engineering
Stephen-Douglas Co., Inc.
2950 Nebraska Avenue
Santa Monica, Calif.

Support for Soaring

Your editorial May 3, "We Can't Afford a Soaring Team?" is highly appreciated by all of us who are interested in the possibilities of gliding and soaring as a wholesome national sport and a possible aviation education medium.

You may know that the Soaring Society has long sought moral and financial encouragement from the aviation industry and has often wondered why the automobile industry has been allowed to provide the only real support for model aviation.

Aviation is one of the few industries that has the possible advantage of cultivating amateur interests to its great benefit, both in personnel procurement and customer relations for the future. Almost every other industry has to depend entirely on advertising, which they spend millions of dollars on alone.

The aviation industry could "hand make" customers for a lot less money each year than is spent by the soap industry, as an example, on a single radio or television program. It seems that the industry is satisfied to wait until the youth has prepared himself for a vocation and then visit the colleges and universities in competition with all the other industries to try to win his favor for a career in aviation. It is strange that they do not plan a little farther ahead and sell aviation to the youth during the formative stage of his ambitions, when competition would not be so great and success would be much easier.

A little support for modeling and for gliding and soaring might very well eliminate the need for a great rush to the universities and colleges each May and June.

Jon D. Carsey
8318 Inwood Road
Dallas 9, Tex.

Missiles & Tubes

The fourth issue of our RETMA Electronic Applications Reliability Review will be circulated in about three months. I would like to include in our next issue the article, "Missiles Impose New Hurdles for Tubes", in the Mar. 22 Aviation Week. Do you have reprints of this article available? If so, how much would 6,000 copies cost?

Lewis M. Clement, Chairman
Electronic Applications Committee
(Reliability)
c/o Crosley Division, Avco Mfg. Corp.
Evendale Plant—Box 116
Cincinnati 15, Ohio

Praise

Please accept our belated appreciation of the great way in which George Christian and Aviation Week handled the recent story on our expansion.

Al Harting, Director of Pub. Rel.
Southwest Airmotive Co.
Love Field
Dallas 9, Tex.

The copy of Aviation Week which you forwarded to us was received safely at Feltwell.

Not only did it provide a good source of information, but almost our only source of current information on the U. S. Naval air force.

On behalf of the members of our course, I should like to thank you for the prompt assistance which you have given us in this matter.

J. G. Temple
No. 2 Officers' Mess
Royal Air Force
Feltwell,
Thetford,
Norfolk

. . . We enjoyed reading the excellent article by George Christian on our Denver operating base. He really did a job in getting a whale of a lot of facts in fast time, then in putting them together into a most readable article.

R. M. Rummel
Director of Publicity
United Air Lines
Chicago 38, Ill.

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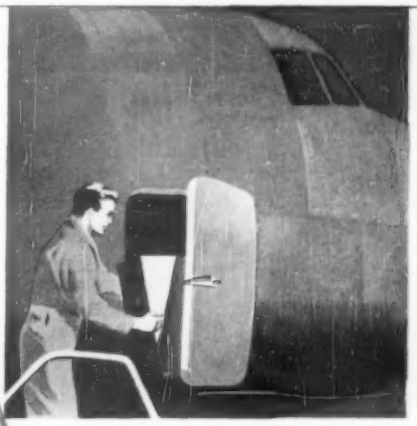
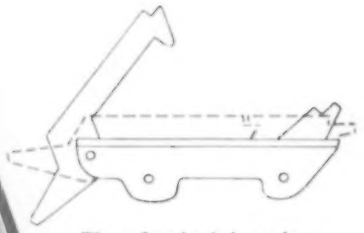


Working closely with the engineers of an aircraft component manufacturer,* Harvey engineers designed a flush-mounted safety lock for external aircraft access doors. By using aluminum extrusions rather than machining the bolt and trigger from bar stock, production costs were reduced by 62%. The use of extrusions virtually eliminated the costly machining operation and at the same time stepped up the unit rate of production approximately 38%. If you use structural metal in your business, Harvey Aluminum extrusions will help reduce your costs. We hope you'll get in touch with a Harvey Field Engineer without delay.

** Name on request*



The safety latch is made up from the cross section of two aluminum extrusions. Harvey engineers bypassed machining, casting and forging to cut the client's costs.

The men at Harvey are dedicated to the idea of improving your product while reducing your costs. And remember, Harvey prepays the freight to your plant.

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THE AIRFRAME'S THE SAME —THE POWER'S TURBO-PROP

Here is the Convair YC-131C Military Transport, a conversion to Allison Turbo-Prop power of the Model 340 Convair-Liner. Modified under an Air Force contract, the YC-131C is now flying powered by two Allison YT56 Turbo-Prop engines driving Aeroproducts propellers.

With this installation the Air Force is leading the way in testing the practical operating usefulness of Turbo-Prop engines—paving the way for the change from reciprocating to Turbo-Prop engines in transport and logistic aircraft.

Allison Turbo-Prop design and performance characteristics can help today's transports meet tomorrow's advanced operational requirements of:

- **Increased Payloads**
- **Higher Cruising Speeds**
- **Lower Fuel Cost**
- **Less Maintenance Time and Cost**
- **Shorter Take-offs and Landings**
- **Greater Passenger Comfort**
- **Reduced Ground Handling Time**
- **Reduced Crew Fatigue**

Since December 1950, Allison has conducted extensive flight tests with its own Turbo-Liner to exploit the advantages inherent in Turbo-Prop power for transport service. In addition, the Navy is accumulating experience in the Douglas A2D Skyshark and the Convair R3Y Tradewind—also powered by Allison Turbo-Prop engines driving Aeroproducts propellers.

Today that pioneering is paying off in the availability of Turbo-Prop engines and propellers which will enable military and commercial aircraft to carry bigger payloads, farther, faster and more economically.

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